



Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Appendix 2 - Sandwich Tern Compensation Document

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Prepared by:	
MacArthur Green and Royal HaskoningDHV	
Approved by:	Date:
Sarah Chandler, Equinor	August 2022

Table of Contents

SANDWICH TERN COMPENSATION DOCUMENT	8
1 Introduction.....	8
1.1 Background	8
1.2 Purpose of Document.....	8
1.3 Implications of the Project Development Scenarios.....	9
2 Legislation and Guidance.....	10
2.1 UK National Legislation	10
2.2 Guidance on Compensatory Measures.....	11
3 Development of Compensatory Measures – Methodology	13
3.1 General Approach	13
3.2 Summary of Consultation Undertaken	14
4 Relevant SPAs for Sandwich Tern.....	16
4.1 North Norfolk Coast SPA	16
4.2 Greater Wash SPA.....	22
5 Summary of Potential Impacts on Sandwich Tern from SEP and DEP	23
5.1 North Norfolk Coast Special Protection Area.....	23
5.2 Greater Wash Special Protection Area	26
6 Compensatory Measures	29
6.1 Potential Measures Considered	29
6.2 Summary of Discounted Measures and Rationale.....	34
6.3 Prey Enhancement through Sandeel Stock Recovery and Sprat Stock Protection – Ecosystem-Based Management Approach.....	38
6.4 Nesting Habitat Improvements and Restoration of Lost Breeding Range at Scar Point, Loch Ryan	43
6.5 Improved Breeding Success at SPA Sites other than NNC – Farne Islands SPA	63
7 Summary	73
8 References	74

Table of Tables

Table 4-1: Annual Sandwich Tern Population Estimation and Breeding Success at the NNC SPA by Breeding Colony Since 2010 (JNCC, 2021).	20
Table 6-1: Measures and Topics for Sandwich Tern Reviewed in the Sandwich Tern and Kittiwake Ecological Evidence Review	30
Table 6-2: Summary of Compensatory Measures for Sandwich Tern and Delivery Model	33
Table 6-3: Sandwich Tern Discounted Measures and Rationale	35
Table 6-4: Outline Roadmap for the Implementation and Delivery of the Loch Ryan Nesting Habitat Improvements	56
Table 6-5: Potential Impacts from Implementation of the Loch Ryan Nesting Habitat Improvements.....	60
Table 6-6: Outline Roadmap for the Implementation and Delivery of the Measures to Improve Breeding Success at Farne Islands SPA	70

Table 6-7: Potential Impacts from Implementation of the Measures to Improve Breeding Success at the Farne Islands..... 72

Table of Plates

Plate 4-1: Number of Pairs (AONs) of Sandwich Tern Recorded at NNC SPA from 1969 to 2018, With Best Linear Trend Line Fitted. Data from JNCC SMP Database. There is No Significant Long-Term Trend Over this Period..... 19

Plate 4-2: Number of Pairs (AONs) of Sandwich Tern Recorded at NNC SPA from 2008 to 2018, With Best Linear Trend Line Fitted. Data from JNCC SMP Database. The Trend Since 2008 Has Been a Statistically Significant Increase in Breeding Numbers 20

Plate 6-2: Numbers of Pairs of Sandwich Terns Nesting at Farne Islands SPA 1969-2021 (Data from JNCC 2021) Downloaded 31/8/2021. 64

Table of Figures

Figure 6-1: Inland Pool Area of Search and Potential Location of Pontoon at Loch Ryan 49

Glossary of Acronyms

AEol	Adverse Effect on Integrity
BDMPS	Biologically Defined Minimum Population Scales
BEIS	Business, Energy and Industrial Strategy
CGR	Counterfactual of Growth Rate
CIMP	Compensation Implementation and Monitoring Plan
CPS	Counterfactual of Population Size
CRM	Collision Risk Model
DCO	Development Consent Order
Defra	Department for the Environment and Rural Affairs
DEL	Dudgeon Extension Limited
DEP	Dudgeon Offshore Wind Farm Extension Project
DML	Deemed Marine Licence
DO	Dissolved Oxygen
DOW	Dudgeon Offshore Wind Farm
EC	European Commission
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
FID	Final Investment Decision
GW	Gigawatt
HRA	Habitats Regulations Assessment
ICES	International Council for the Exploration of the Sea
IROPI	Imperative Reasons of Over-riding Public Interest
JNCC	Joint Nature Conservation Committee
MCA	Maximum Curvature Analysis
MMO	Marine Management Organisation
MOD	Ministry of Defence
MPA	Marine Protected Area
NE	Natural England
NNC	North Norfolk Coast
OWF	Offshore Wind Farm
OWIC	Offshore Wind Industry Council
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate

PRoW	Public Right of Way
PVA	Population Viability Analysis
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SEL	Scira Extension Limited
SEP	Sheringham Shoal Offshore Wind Farm Extension Project
SEPA	Scottish Environment Protection Agency
SIP	Site Improvement Plan
SMP	Seabird Monitoring Programme
SoS	Secretary of State
SSB	Spawning Stock Biomass
SOW	Sheringham Offshore Wind Farm
SPA	Special Protection Area
STCSG	Sandwich Tern Compensation Steering Group
TAC	Total Allowable Catch
UK	United Kingdom

Glossary of Terms

B _{lim}	A deterministic biomass limit below which a fish stock is considered to have reduced reproductive capacity.
B _{pa}	A fish stock status reference point above which the stock is considered to have full reproductive capacity, having accounted for estimation uncertainty.
Dudgeon Offshore Wind Farm Extension site	The Dudgeon Offshore Wind Farm Extension offshore lease area.
Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure.
European site	Sites designated for nature conservation under the Habitats Directive and Birds Directive. This includes candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation, potential Special Protection Areas, Special Protection Areas, Ramsar sites, proposed Ramsar sites and sites compensating for damage to a European site and is defined in regulation 8 of the Conservation of Habitats and Species Regulations 2017, although some of the sites listed here are afforded equivalent policy protection under the National Planning Policy Framework (2021) (paragraph 176) and joint Defra/Welsh Government/Natural England/NRW Guidance (February 2021) (Defra, 2021a).
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics.
Expert Topic Group (ETG)	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Integrated transmission system	Transmission infrastructure which serves both extension projects.
Sheringham Shoal Offshore Wind Farm Extension site	Sheringham Shoal Offshore Wind Farm Extension lease area.
Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure.
The Applicant	Equinor New Energy Limited. As the owners of SEP and DEP, Scira Extension Limited (SEL) and Dudgeon Extension Limited (DEL) are the named undertakers that have the benefit of the Development Consent Order. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP.

SANDWICH TERN COMPENSATION DOCUMENT

1 Introduction

1.1 Background

1. The Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and Dudgeon Offshore Wind Farm Extension Project (DEP) are proposed extensions to the existing Sheringham Shoal and Dudgeon Offshore Wind Farms (SOW and DOW). When operational, SEP and DEP would have the potential to generate renewable power for around 785,000 United Kingdom (UK) homes from up to 23 wind turbines at SEP and up to 30 wind turbines at DEP.
2. Equinor New Energy Limited (the Applicant) is submitting an application for a Development Consent Order (DCO) including a **Report to Inform Appropriate Assessment (RIAA)** (document reference 5.4), which provides the information necessary for the competent authority to undertake an appropriate assessment to determine if there is any adverse effect on integrity (AEoI) on the national site network.
3. With respect to Sandwich tern from the North Norfolk Coast Special Protection Area (NNC SPA) and the Greater Wash (GW) SPA, the Applicant's RIAA concludes that AEoI cannot be ruled out as a result of predicted Sandwich tern mortality due to collision, and the combined effects of collision and operational phase displacement, when considered in-combination with other offshore wind farms (OWF). As such, the Applicant has provided compensatory measures as part of its consent application to compensate for the predicted impacts from SEP and DEP, which are described in this Sandwich Tern Compensation Document. This forms part of the Applicant's overarching **Habitats Regulations Derogation Provision of Evidence** (document reference 5.5) submission.

1.2 Purpose of Document

4. This document sets out the detail of the proposed compensatory measures for Sandwich tern from the NNC SPA and GW SPA. It demonstrates how the proposed measures can be secured and that the mechanism for delivery can be implemented. The Sandwich Tern Compensation Implementation and Monitoring Plan (CIMP) will be produced by the Applicant and approved by the Secretary of State (SoS) prior to the start of construction, based on the outline version provided with the DCO application (**Annex 2A Sandwich Tern Outline Compensation, Implementation and Monitoring Plan** (document reference 5.5.2.1)). The Sandwich Tern CIMP will set out the detailed delivery proposals for the agreed compensatory measures based on those set out in this Sandwich Tern Compensation Document.
5. As such this document provides the following details (where relevant) for each of the proposed compensatory measures for Sandwich tern:
 - Overview;
 - Delivery Mechanism i.e. how the proposed measures will be delivered;
 - Scale;
 - Location;

- Outline Design Details;
- Timescales;
- Monitoring, Maintenance and Adaptive Management;
- Outline Implementation and Delivery Roadmap; and
- Potential Impacts from Implementation of the Compensation.

1.3 Implications of the Project Development Scenarios

6. SEP and DEP may be delivered under a range of project development scenarios. Details of the scenarios and how these are reflected in the DCO application is set out in the **Scenarios Statement** (document reference 9.28). The pre-application engagement relating to the proposed compensatory measures has assumed that both projects are developed, and the package of measures proposed for NNC/GW SPA Sandwich tern is considered by the Applicant to deliver the level of compensation required in comparable proportion (factoring in the risks and uncertainties associated with delivering successful compensation) to address the worst-case impacts of both SEP and DEP, as required by draft Defra guidance (Defra, 2021b).
7. The scenario under which SEP and/or DEP will be delivered will be confirmed prior to the commencement of the authorised development, and the **Draft DCO** (document reference 3.1) secures the requirement to notify the relevant planning authority and the MMO as appropriate of which scenario is being undertaken. This will need to be confirmed before further requirements of the DCO and conditions of the Deemed Marine Licences (DMLs) can be discharged.
8. The Applicant has considered the requirements for compensation under each project development scenario and has determined that the delivery of the proposed measures under each scenario is dependent on how scalable the given measure is.
9. The project development scenarios for SEP and DEP can be broadly categorised as:
 - In isolation – where only SEP or DEP is constructed;
 - Sequential – where SEP and DEP are both constructed in a phased approach with either SEP or DEP being constructed first; or
 - Concurrent – where SEP and DEP are both constructed at the same time.
10. The **Scenarios Statement** (document reference 9.28) describes the ambition to deliver SEP and DEP with an integrated transmission system, however the predicted impacts on Sandwich tern are no different if the transmission system for the two projects are delivered integrated or separately.
11. Where both projects are delivered in the sequential scenario, the overall final package of compensation to be delivered will be the same as in the concurrent scenario. The Applicant therefore considers it practical to deliver all of the compensation at the same time under either the sequential or concurrent scenario. In the sequential scenario this may mean that one project delivers compensation earlier than may have otherwise been required if it were a standalone project, which could be at risk e.g. prior to Final Investment Decision (FID). The Applicant

considers however that the second project would have the benefit of the compensation being in place slightly longer than the first project thereby reducing pressure on the onward project programme.

12. Should SEP or DEP be delivered in isolation then it would be necessary to deliver only the scale of measures required to achieve adequate compensation in proportion to the impacts predicted from the given project (SEP or DEP). Where this is not practical because the measure is not ecologically scalable, the Applicant is proposing to deliver the compensation measure to its full extent. Where compensation is scalable, or partially scalable, compensation would be delivered on a scale appropriate to the nature and extent of the predicted impact from SEP, or from DEP.
13. It should be noted that, as owners of SEP and DEP, Scira Extension Limited (SEL) and Dudgeon Extension Limited (DEL) are the named undertakers that have the benefit of the DCO. References throughout this document and any supporting annexes to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP.

2 Legislation and Guidance

14. The Habitats Regulations Assessment (HRA) process covers those features designated under the European Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive') and Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive'). These are implemented into UK legislation by the Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017. The UK also has to meet its obligations under relevant international agreements such as the Ramsar Convention.
15. The UK exited the European Union (EU) on 31st January 2020. The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 provide amendments to the Habitats Regulations to enable their continued operation following the UK's exit from the EU (see [Section 2.1](#)).
16. The Birds Directive provides a framework for the conservation and management of wild birds in Europe. The relevant provisions of the Directive are the identification and classification of SPAs for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive.
17. Full details of the relevant legislative and policy context are provided in the [Habitats Regulations Derogation Provision of Evidence](#) (document reference 5.5).

2.1 UK National Legislation

18. The Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (hereafter the 'Habitats Regulations') together with the Wildlife and Countryside Act 1981 transpose the Habitats and Birds Directives into UK legislation covering terrestrial areas out to and

including the UK Offshore Marine Area with the exception of within Scottish territorial waters, where The Conservation (Natural Habitats, &c.) Regulations 1994 continue to apply.

19. The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (the EU Exit Regulations) make changes to the Habitats Regulations so that they continue to work (are operable) following the UK's exit from the EU on 31st January 2020. While the basic legal framework for HRA is maintained, the EU Exit Regulations transfer functions previously undertaken by the EC to UK Ministers. Furthermore, where the Habitats Regulations continue to use the term 'European sites', those sites now form part of a 'national site network' rather than the European 'Natura 2000' site network.
20. The Habitats Regulations place an obligation on 'competent authorities' to carry out an appropriate assessment of any proposal likely to significantly affect a designated site, to seek advice from Natural England and not to approve an application that would have an adverse effect on a designated site unless certain conditions are met (where there are no alternative solutions, the plan or project can only proceed if there are imperative reasons of over-riding public interest and if the necessary compensatory measures can be secured). The competent authority in the case of SEP and DEP is the SoS for Business, Energy and Industrial Strategy (BEIS).

2.2 Guidance on Compensatory Measures

21. Should the Competent Authority conclude that, following Appropriate Assessment, an AEoI on a European site cannot be ruled out, that there are no alternative solutions and that there are Imperative Reasons of Over-riding Public Interest (IROPI), Article 6(4) of the Habitats and Birds Directives "*requires that all necessary compensatory measures are taken to ensure the overall coherence of the network of European sites as a whole is protected.*"
22. Department for the Environment and Rural Affairs (Defra) (2021a) and European Commission (EC) (2012 and 2018) explain that for SPAs, the overall coherence of the European site network can be maintained by:
 - Compensation that fulfils the same purposes that motivated the site's designation;
 - Compensation that fulfils the same function along the same migration path; and
 - The compensation site(s) are accessible with certainty by the birds usually occurring on the site affected by the project.
23. The guidance provides an element of flexibility, recognising that compensation of a 'like for like' habitat and/or in the same designated site may not be practicable.
24. Compensation should not be used to address issues that are causing designated habitats or species to be in an unfavourable condition. This is the responsibility of the UK Government.
25. Ideally, compensation should be functioning before the effect takes place, although it is recognised that this may not always be possible, as stated in the Defra (2021a) and EC (2012) guidance: "*in principle, the result of implementing compensation has normally to be operational at the time when the damage is effective on the site*

concerned. Under certain circumstances where this cannot be fully fulfilled, overcompensation would be required for the interim losses.”

26. Draft guidance has been published by Defra ‘Best practice guidance for developing compensatory measures in relation to Marine Protected Areas’ (Defra, 2021b), including a hierarchy within which to consider compensatory measures for the marine environment. This guidance also recognises the potential issues with the ability to provide ‘like-for-like’ compensation stating:

“As it will not always be possible to deliver compensatory measures in a like-for like capacity as is accepted terrestrially, Defra has created a framework to help advisors, regulators and developers to explore and develop compensatory measures. The underlying principle is that compensatory measures that benefit the same feature which is impacted by the development will be the most preferable as they balance the damage caused by the development.

Each step down the hierarchy moves away from like for like measures and therefore may decrease the certainty of success, and therefore increase the extent of compensation required. The key is to ensure the biological structure and function of the network is maintained. The more significant the impact to the protected feature or species, the more important it is that compensatory measures are developed within steps 1 and 2 of the Hierarchy of Compensatory Measures.”

27. Compensatory measures for Sandwich tern are presented in the following sections in line with this guidance and the hierarchy presented within it.

28. In addition, Natural England has developed a list of those aspects of compensatory measures that it considers need to be described in detail when developers are submitting or updating applications where impacts on marine protected areas (MPA) are anticipated. Whilst not exhaustive, it lists key areas where Natural England considers sufficient detail is needed to provide the SoS with appropriate confidence that compensatory measures can be secured. The list is summarised below:

- What, where, when: clear and detailed statements regarding the location and design of the proposal;
- Why and how: ecological evidence to demonstrate compensation for the impacted site feature is deliverable in the proposed locations;
- Demonstrate that on ground construction deliverability is secured and not just the requirement to deliver in the DCO i.e. landowner agreement is in place;
- Policy/legislative mechanism for delivering the compensation (where needed);
- Agreed DCO/DML conditions;
- Clear aims and objectives of the compensation;
- Mechanism for further commitments if the original compensation objectives are not met – i.e. adaptive management;
- Clear governance proposals for the post-consent phase – we do not consider simply proposing a steering group is sufficient;
- Ensure development of compensatory measures is open and transparent as a matter of public interest, including how information on the compensation would be publicly available;

- Timescales for implementation esp. where compensation is part of a strategic project, including how timescales relate to the ecological impacts from the development;
- Commitments to monitoring specified success criteria;
- Proposals for ongoing 'sign off' procedure for implementing compensation measures throughout the lifetime of the project. Including implementing feedback loops from monitoring; and
- Continued annual management of the compensation area and ensure other factors are not hindering the success of the compensation e.g. changes in habitat, increased disturbance as a result of subsequent plans/projects.

29. This list, and an equivalent list provided by the Royal Society for the Protection of Birds (RSPB) has been used to help guide the development of the proposed compensatory measures at the pre-application stage.

3 Development of Compensatory Measures – Methodology

3.1 General Approach

30. The approach taken by the Applicant to identify potential compensatory measures and for considering their suitability is as follows (also see [Appendix 1 Compensatory Measures Overview](#) (document reference 5.5.1)):

- Review of compensatory measures discussed in Furness *et al.* (2013) (see [Section 6.1](#));
- Iterative development of the proposals through a detailed process of consultation with relevant stakeholders, implemented in this case through an extension to the ornithology Expert Topic Group (ETG) as part of the Projects' Evidence Plan Process (EPP). This group includes the Marine Management Organisation (MMO), Natural England, RSPB and National Trust. The Planning Inspectorate (PINS) were also invited to attend. Details of the consultation undertaken including minutes of the ETG meetings are provided in the [Consultation Report](#) (document reference 5.1);
- Engagement with other stakeholders where necessary including with other OWF developers, Natural England and Defra either directly or through the Offshore Wind Industry Council (OWIC) Derogation Subgroup;
- Ongoing review of other OWF applications for which compensatory measures have been presented (e.g. Hornsea Project Three, Norfolk Vanguard and Norfolk Boreas, East Anglia TWO/ONE North and Hornsea Project Four), including those accepted as appropriate in the determination of these applications (to date all of these projects other than Hornsea Project Four which is yet to be determined);

- Consideration of emerging evidence on OWF and seabird interactions and influences on seabird ecology more widely to determine whether novel options may be appropriate;
- Features of the compensatory options identified through this process were then considered in relation to various criteria (feasibility, spatial and temporal scale, how it would be monitored, etc.); and
- Targeted consultation with relevant stakeholders as necessary to help inform the development of specific compensatory measures.

31. As described in **Section 6.1**, project-led, collaborative and strategic delivery models have been considered. Those measures that would appear to be more appropriate to be taken forward as part of a collaborative approach with other developers, or a strategic approach by Government and industry, or a combination of the two, are described in detail in the **Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8).

3.2 Summary of Consultation Undertaken

32. The Applicant has given early and detailed consideration to the requirement for compensatory measures and has consulted with a range of stakeholders at regular intervals throughout the pre-application process. Feedback from the consultation has been used to shape the development of the compensatory measures. Consultation has included:

- As described above, an Ornithology Compensation ETG was set up as a part of the Projects' EPP. Of relevance to Sandwich tern, ETG members have included the MMO, Natural England, RSPB and National Trust. Three Ornithology Compensation ETG meetings were held between January and June 2022, with compensatory measures also being discussed at earlier stages of the pre-application process as part of the Offshore Ornithology ETG meetings, in December 2020 and August 2021;
- In March 2021 the Applicant provided ETG members with an initial review of potential compensatory measures for Sandwich tern (**Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake** (document reference 5.5.1.1)). This document was developed to inform early pre-application consultation with ETG members and was provided ahead of the Section 42 consultation on the Preliminary Environmental Information Report (PEIR) and draft Information for HRA Report to maximise the timeframe available for discussions on compensatory measures in the pre-application period. It provided an initial review of potential compensatory measures, based on those discussed in Furness *et al.* (2013), with the aim of identifying the opportunities and constraints associated with each and the necessary next steps in determining a feasible approach in the context of SEP and DEP. Written feedback on this review was provided by Natural England in May 2021;

- In November 2021 the Applicant provided ETG members with a detailed review of the ecological evidence supporting the potential compensatory measures that had been identified to date (**Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2)). The review addressed a number of specific issues relevant to Sandwich tern compensatory measures where further information had been indicated by stakeholders in the March 2021 consultation as being of benefit in determining the suitability and feasibility of the measures under consideration. Feedback on this review was discussed with the Ornithology Compensation ETG in January 2022, following receipt of written responses from Natural England, RSPB and National Trust;
- In April 2022 the Applicant provided ETG members with an HRA Compensation Briefing Note, which was designed to share the main updates in the development of the proposed compensatory measures since the last round of consultation in January 2022 and to enable more targeted engagement around the key remaining issues and questions. This included an update on all potential measures still under consideration at that time, with detailed information provided on Sandwich tern nesting habitat improvement at Scar Point, Loch Ryan. The briefing note also provided details of the delivery models for each of the measures under consideration. Feedback was discussed with the Ornithology Compensation ETG in April 2022;
- In the April 2022 ETG meeting, ETG members expressed a wish to have one further meeting pre-application and to use this as an opportunity to review the detailed compensatory measures proposals against the lists that had been provided by both Natural England and RSPB for other OWF applications (included at **Section 2.2**). To help inform this exercise the Applicant provided a further document for consultation in June 2022, detailing the proposed measure of providing ‘nesting habitat improvements and restoration of lost breeding range at Scar Point, Loch Ryan’, which had emerged as the leading measure. Feedback was discussed with the Ornithology Compensation ETG in a final pre-application meeting held in late June 2022;
- Additional meetings were held with other relevant stakeholders as necessary to discuss the proposals as they were developed. This included meetings with Natural England, RSPB, National Trust, Crown Estate Scotland, Marine Scotland and NatureScot;
- Meetings were held with PINS through the pre-application process in order to appraise them of the intended approach to the derogation case for the Projects and the development of the associated compensatory measures (meetings held in November 2020, February 2021, January 2022 and July 2022); and
- Opportunities for the development of strategic approaches to compensation were discussed directly with Defra, including in meetings in June 2021, December 2021, March 2022 and July 2022.

33. A full record of the consultation undertaken, the feedback received and the regard given to this by the Applicant in developing the compensatory measures are provided in **Annex 1D Record of HRA Derogation Consultation** (document reference 5.5.1.4). Minutes and agreement logs for the ETG meetings are appended to the **Consultation Report** (document reference 5.1).

4 Relevant SPAs for Sandwich Tern

4.1 North Norfolk Coast SPA

4.1.1 Overview

34. The North Norfolk Coast SPA (NNC SPA) and Ramsar site is located east of The Wash on the northern coastline of Norfolk, and covers an area of nearly 8,000 hectares extending approximately 40 km from Holme to Weybourne. The SPA was originally designated in January 1989, but the European Site Conservation Objectives were updated in February 2019. A variety of coastal habitats occur within the SPA, including intertidal mudflats and sandflats, coastal waters, saltmarshes, shingle, sand dunes, freshwater grazing marshes and reedbeds. The North Norfolk Coast is also designated as a Ramsar site.
35. The site is important within Europe as one of the largest areas of undeveloped coastal habitat of its type, and at designation was the fourth most important wetland site for waterfowl in Britain.
36. The coastal waters along the North Norfolk Coast are shallow and follow the complex series of harbours and inlets along the coast. These support large populations of small fish including sandeel and sprat which provide vital food for breeding tern populations that occur within the SPA. The SPA citation states that the site qualifies under Article 4.1 of the Birds Directive by supporting up to 4,500 pairs of Sandwich terns (4,275 pairs according to the Ramsar site citation), up to 1,000 pairs of common terns (408 pairs according to the Ramsar site citation), and up to 400 pairs of little terns (291 pairs according to the Ramsar site citation).
37. The site also qualifies under Article 4.1 of the Birds Directive by supporting nationally important numbers of bittern, marsh harrier, Montagu's harrier, and avocet. As well as these species, smaller proportions of the national breeding populations of other species listed on Annex 1 of the Birds Directive are supported by the SPA; namely Arctic tern, kingfisher and short-eared owl.
38. The site qualifies under Article 4.2 of the Birds Directive as an internationally important wetland, regularly supporting, in winter, over 10,000 wildfowl (average over 20,000) and internationally important numbers of the following waterfowl species: 9,000 dark-bellied brent geese (8,960 according to the Ramsar site citation), 6,000 pink-footed-geese (16,787 according to the Ramsar site citation), 6,000 knot (30,781 according to the Ramsar site citation) and 5,600 wigeon (17,940 according to the Ramsar site citation). These species are joined on the Ramsar site citation by 1,148 pintails.
39. Whilst not qualifying features of the SPA, nationally important wintering numbers of the following species are also supported: 270 European white-fronted geese, 450 pintails, 2600 shelducks, 500 grey plovers, 400 ringed plovers, 5,000 oystercatchers

and 800 redshanks. In addition, many of the huge wader flocks which feed in The Wash regularly use the western parts of this site as a safe high-water roost. The site supports also nationally important breeding populations of gadwall, shoveler, garganey, black-tailed godwit, bearded tit and parrot crossbill.

4.1.2 Conservation Objectives

40. The site's conservation objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:
- The extent and distribution of the habitats of the qualifying features;
 - The structure and function of the habitats of the qualifying features;
 - The supporting processes on which the habitats of the qualifying features rely;
 - The populations of each of the qualifying features; and
 - The distribution of qualifying features within the site.
41. More detailed conservation objectives have since been added online, last updated 13 September 2019 (Natural England 2020). For Sandwich tern at NNC SPA these are:
- Restore the size of the breeding population to a level which is above 4,500 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.
 - Maintain safe passage of birds moving between nesting and feeding areas.
 - Reduce the frequency, duration and/or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed.
 - Restrict predation and disturbance caused by native and non-native predators.
 - Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).
 - Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.
 - Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at levels described in site specific supporting notes.
 - Maintain the distribution, abundance and availability of key food and prey items (e.g. sandeel, sprat) at preferred sizes. The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population.

- Maintain the availability of shallow sloping nesting sites, grading to <30 cm above water level, restricting the probability that they will flood.
- Maintain vegetation cover which should be <10% throughout areas used for nesting, providing sufficient bare ground for the colony as a whole.
- Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.
- Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.
- Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels.
- Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.

42. In addition, a Site Improvement Plan was published in December 2014, outlining the prioritised issues for the site and features, and the proposed measures to address those issues – see [Section 4.1.4](#) for further information.

4.1.3 Designated Features – Breeding Sandwich Tern

43. The biogeographic population of Sandwich tern (*Thalasseus sandvicensis*) was estimated at 74,000 pairs, of which 11,000 pairs breed in Great Britain and 3,700 pairs in all-Ireland (Mitchell *et al.*, 2004)¹. Sandwich tern breeding numbers in the UK increased from the 1920s to the mid-1980s, after major reductions caused by human exploitation and hunting (Joint Nature Conservation Committee (JNCC) 2020). National surveys showed an increase in the UK population of 33% from 1969 to 1986, but a decrease of 15% from 1986 to 2000 (JNCC 2020). JNCC Seabird Monitoring Programme (SMP) data show no clear long-term trend for UK breeding numbers between 1986 and 2018, with the index in 2018 almost the same as in 1986 (JNCC 2020).
44. Stroud *et al.*, (2016) identified that the SPA suite with breeding Sandwich tern as a designated feature has 13 qualifying sites in Great Britain, three in Scotland (Forth Islands SPA; Loch of Strathbeg SPA; Ythan Estuary, Sands of Forvie and Meikle Loch SPA), nine in England (Alde-Ore Estuary SPA; Chichester and Langstone Harbours SPA; Coquet Island SPA; Duddon Estuary SPA; Farne Islands SPA; Foulness SPA; Morecambe Bay SPA; NNC SPA; Solent and Southampton Water SPA) and one in Wales (Ynys Feurig, Cemlyn Bay and The Skerries SPA, now known as Anglesey Terns SPA). The SPAs in Great Britain were estimated to hold

¹ All population estimates discussed in this document are from before impacts of Highly Pathogenic Avian Influenza on Sandwich tern became evident.

72% of the Great Britain breeding population of Sandwich terns present in 2000 (Stroud *et al.*, 2016). Three sites in Northern Island also qualify (Carlingford Lough; Larne Lough; and Strangford Lough). NNC SPA held 3,700 pairs of Sandwich terns at designation, the largest breeding population of the species in the UK SPA suite. Numbers have decreased at many of the SPA sites, but have increased at some, including NNC SPA, such that the overall change since designation is small. Similarly, the JNCC seabird monitoring index for Sandwich tern suggests that current numbers in England (in 2020) are very similar to numbers present in 1986; the index in 2020 being essentially the same as in 1986 despite periods in the mid-1990s and early 2010s when the index fell below 100 (JNCC, 2020).

- 45. Within the boundary of the NNC SPA, Sandwich terns breed at two principal colonies; Blakeney Point and Scolt Head (JNCC, 2020; Perrow *et al.*, 2017). Alternative breeding locations within the SPA, such as Holkham, have been unused since 2004 (JNCC, 2020).
- 46. Long-term and short-term trends in the NNC SPA Sandwich tern population are described in the data presented in **Plate 4-1** and **Plate 4-2** (showing number of pairs from Apparently Occupied Nests (AONs)), whilst **Table 4-1** presents population and productivity data from the last ten years. Though population size has at times fluctuated since 1989, the recent trend is an increasing one (**Plate 4-1**).

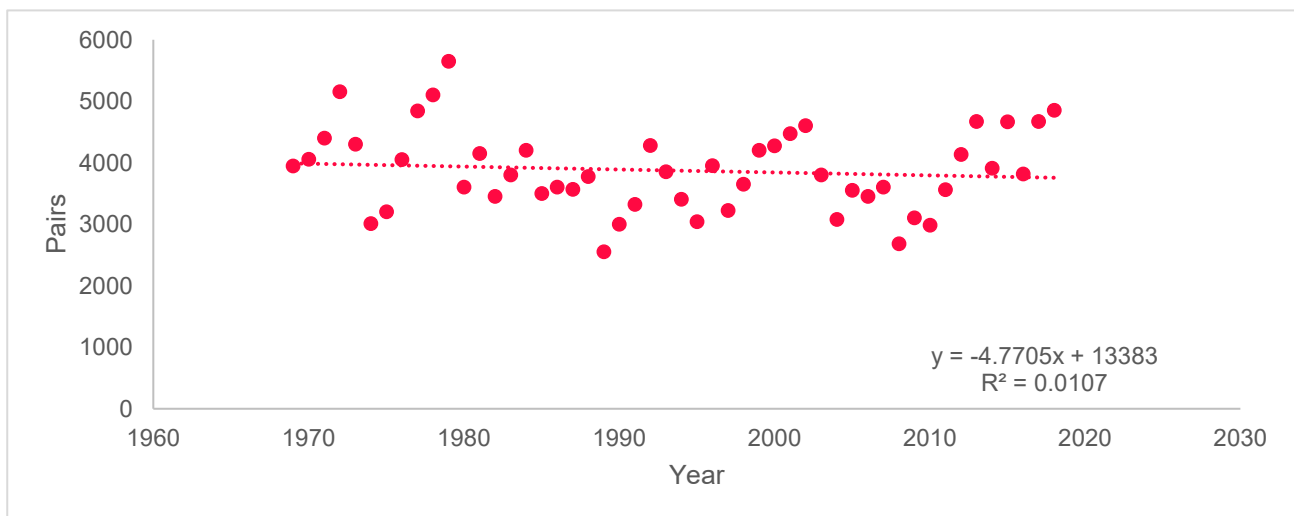


Plate 4-1: Number of Pairs (AONs) of Sandwich Tern Recorded at NNC SPA from 1969 to 2018, With Best Linear Trend Line Fitted. Data from JNCC SMP Database. There is No Significant Long-Term Trend Over this Period

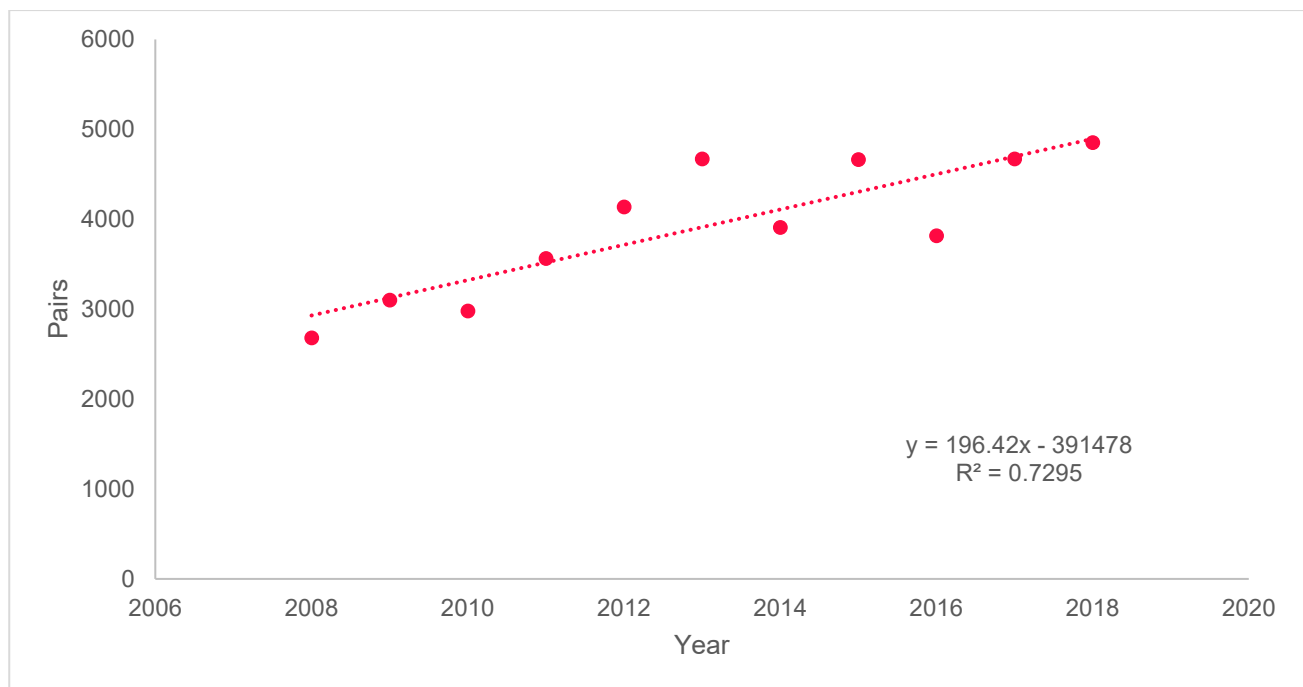


Plate 4-2: Number of Pairs (AONs) of Sandwich Tern Recorded at NNC SPA from 2008 to 2018, With Best Linear Trend Line Fitted. Data from JNCC SMP Database. The Trend Since 2008 Has Been a Statistically Significant Increase in Breeding Numbers

Table 4-1: Annual Sandwich Tern Population Estimation and Breeding Success at the NNC SPA by Breeding Colony Since 2010 (JNCC, 2021).

Year	Scolt Head		Blakeney Point		Total Adults
	AON	Success	AON	Success	
2010	480	0	2,500	0.36	5,960
2011	0	-	3,562	0.52	7,124
2012	400	0	3,735	0.59	8,270
2013	550	0	4,120	0.44	9,340
2014	1,050	0.60	2,859	0.19	7,818
2015	3,550	0.90	1,113	0.01	9,326
2016	3,365	0.80	451	0.39	7,632
2017	4,665	0.94	3	0	9,336
2018	4,685	0.85	165	0.12	9,700
2019	3,805	0.74	788	0.51	9,186

Year	Scolt Head		Blakeney Point		Total Adults
	AON	Success	AON	Success	
2020	4,160	0.72	2,425	0.45	13,170

47. Since 2015, the majority of Sandwich terns breeding in the NNC SPA have been located at Scolt Head, and not Blakeney Point, which was the location with the most breeding activity from 1979 to 2015, but held very few birds before 1976 (JNCC, 2020).
48. The selection of a preferred breeding location within the NNC SPA generally shifts every few years, and is thought to be due to a number of reasons. These include the presence of black-headed and large gulls at the start of the breeding season, the presence of non-avian predators (e.g. foxes), and the state of vegetation. Sandwich terns are highly vulnerable to mammal predators and declines at colonies are most often related to an increase in predator access, especially to foxes, but also rats, stoats and American mink. Predators can cause complete abandonment of a colony, or periodic breeding failure (Mitchell *et al.*, 2004). Predation by gulls can also influence breeding success but tends to be less of a problem than predation by mammals. Sandwich tern nesting habitat is dynamic, with influences of coastal erosion and flooding potentially leading to habitat loss, and of plant succession potentially leading to habitat becoming overgrown and unsuitable for this species (Mitchell *et al.*, 2004). Sandwich terns have been affected by chemical pollution, with very large decreases in breeding numbers in the Netherlands in the 1960s (Mitchell *et al.*, 2004) but that pressure has been reduced. Breeding success can be strongly affected by forage fish abundance and breeding failures have been related to reductions in stocks of sandeel, sprat and juvenile herring (see **Annex 1B: Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2) for further information). Overwinter survival may be influenced by fisheries off West Africa affecting abundance of forage fish in that region (Mitchell *et al.*, 2004), and deliberate trapping of birds at the West African coast for sport and food has been identified as affecting survival, especially of immature birds.

4.1.4 NNC SPA Site Improvement Plan (SIP) in Relation to Sandwich tern

49. Natural England identify the threats and pressures on Sandwich tern within NNC SPA and management actions in relation to these as follows (published 19 December 2014):
- Public access / disturbance:
 - Investigate and identify measures to counteract effects of disturbance. Coordinate information exchange regarding sensitive areas. Timescale 2014-2020. Funding option “*not yet determined*”.
 - Fisheries: Recreational marine and estuarine:
 - Implement the recreational sea angling strategy. Timescale 2015-2020. Funding option “*not yet determined*”.

- Fisheries: Commercial marine and estuarine:
 - Put in place necessary management measures. Introduction of management measures by Eastern Inshore Fisheries Conservation Authority. Timescale 2016 onwards. Funding option Defra, Natural England.
- Predation:
 - Ensure adequate protection of nesting birds from predators. Timescale 2014-2020. Funding option “*not yet determined*”.
- Inappropriate coastal management:
 - Although not specifically linked to Sandwich tern in the SIP, the plan states “Investigate the options for adaptive site management in light of ecological changes likely to occur due to increased frequency and duration of saline inundation”. Timescale 2014-2016. Funding option “not yet determined”.

4.2 Greater Wash SPA

4.2.1 Overview

50. The Greater Wash SPA is a marine SPA located in the mid-southern North Sea between Bridlington Bay in the north and the Outer Thames Estuary SPA in the south. The SPA boundary encompasses the offshore areas identified as being most important for the qualifying bird species based on site-specific surveys and modelling. The SPA covers an area of 3,536 km².
51. To the north, off the Holderness coast in Yorkshire, sea bed habitats primarily comprise coarse sediments, with occasional areas of sand, mud and mixed sediments. Subtidal sandbanks occur at the mouth of the Humber Estuary, primarily comprising sand and coarse sediments. Offshore, soft sediments dominate, with extensive areas of subtidal sandbanks off The Wash as well as north and east Norfolk coasts. Closer inshore at The Wash and north Norfolk coast, sediments comprise a mosaic of sand, muddy sand, mixed sediments and coarse sediments, as well as occasional Annex I reefs. The area off the Suffolk coast continues the mosaic habitats mostly dominated by soft sediment.
52. The landward boundary of the SPA covers the coastline from Bridlington Bay in the north (at the village of Barmston), to the existing boundary of the Outer Thames Estuary SPA in the south. Across the mouth of the Humber Estuary, the boundary abuts the boundary of the Humber Estuary SPA, except where neither the little tern foraging zone or the red-throated diver Maximum Curvature Analysis (MCA) density threshold reaches the SPA. The landward boundary abuts the seaward boundary of The Wash SPA except where the former overlaps the latter to encompass the foraging area of Sandwich tern.
53. The seaward boundary lies approximately 14 nautical miles (nm) from the shore at its furthest extent and is defined by the distribution of red-throated diver along the length of the SPA, with a small length off the north Norfolk Coast defined by the area used by foraging Sandwich tern.

4.2.2 Conservation Objectives

54. The SPA's conservation objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:
- The extent and distribution of the habitats of the qualifying features.
 - The structure and function of the habitats of the qualifying features.
 - The supporting processes on which the habitats of the qualifying features rely.
 - The populations of each of the qualifying features.
 - The distribution of qualifying features within the site.

4.2.3 Designated Features – Breeding Sandwich Tern

55. The Sandwich terns that make up the qualifying feature of this SPA breed within the NNC SPA and Ramsar site. Details on the status of these populations are provided in **Section 4.1.3**, and are not reproduced here.
56. The citation for the Greater Wash SPA (Natural England, 2018) states that the population of Sandwich terns associated with the SPA is 3,852 pairs, which was the peak mean count of birds present at the NNC SPA and Ramsar site between 2010 and 2014. More recent counts (2018) indicate that the population has increased to 4,850 pairs, or 9,700 individuals. The baseline mortality of this population, assuming an adult mortality rate of 0.102 (Horswill and Robinson 2015), is 989 birds per year.
57. The Greater Wash SPA protects offshore waters that are considered to represent important marine areas for this species. These were defined by data collected by a programme of boat-based visual tracking of foraging birds. The resultant information on foraging locations chosen by the birds was combined with information on the habitat characteristics of those locations relative to other areas available, to construct habitat association models of tern usage (Wilson *et al.*, 2014). These models were used to predict species-specific tern usage patterns around breeding colony SPAs. Further details on the methodologies employed are provided in the Departmental Brief for the SPA (Natural England and JNCC, 2016).

5 Summary of Potential Impacts on Sandwich Tern from SEP and DEP

5.1 North Norfolk Coast Special Protection Area

5.1.1 Overview

58. The screening process undertaken in the development of **Environmental Statement (ES) Chapter 11 Offshore Ornithology** (document reference 6.1.11) has identified Sandwich tern as being of medium sensitivity to potential collision with operational offshore wind turbines at SEP and DEP, as well as disturbance and displacement during the operational phase of the Projects. This species is considered to be insensitive to disturbance and displacement impacts during the construction and decommissioning phases, and any indirect impacts that may occur as a result of the construction, operation or decommissioning of SEP and DEP.

59. Breeding adult Sandwich terns present at SEP and DEP during the full breeding season (April to August (Furness, 2015)) are assumed to originate from the NNC SPA, even though non-breeding adults from a range of breeding colonies are also likely to be present. In addition, some of the Sandwich terns recorded at SEP and DEP during the breeding season may be sub-adult birds.
60. Outside the breeding season breeding Sandwich terns are assumed to range widely and to mix with birds of all ages from breeding colonies in the UK and further afield. The relevant background population is considered to be the UK North Sea and Channel BDMPS, consisting of 38,051 individuals during autumn migration (July to September), and spring migration (March to May) (Furness, 2015).
61. Estimates of the proportion of Sandwich terns present at SEP and DEP during the autumn and spring migration seasons which originate from the NNC SPA and Ramsar site are based on the SPA population as a proportion of the UK North Sea and Channel BDMPS (Furness, 2015). During both autumn and spring migration seasons, breeding adult Sandwich terns from the NNC SPA and Ramsar site make up 21.8% of the total BDMPS population. The same percentage of impacts are therefore attributable to birds from this SPA during these times of year.

5.1.2 Quantification of Effect – Collision and Displacement

62. The potential collision risk for Sandwich tern at SEP and DEP was estimated using the Band (2012) collision risk model (CRM). Full details of the input parameters used are provided in **Appendix 11.1 Offshore Ornithology Technical Report** (document reference 6.3.11.1) of the ES.
63. The potential magnitude of operational phase displacement at SEP and DEP was estimated using the matrix-based approach of UK SNCBs (2017). For this species, displacement and mortality rates of zero to 0.500 and 1% respectively were examined by the assessment. Full details are provided in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11).
64. To generate the worst-case scenarios presented below, it is assumed by the assessment that no macro-avoidance occurs, though evidence from other OWFs indicates that this is not likely. The approach taken to identifying the scale of compensation required is therefore considered to be precautionary.
65. It should also be noted that both design-based and model-based densities were produced for Sandwich tern, and the sections below present assessment outputs using both sets of density estimates.

5.1.2.1 Project-Alone (SEP and DEP)

66. The combined worst-case SEP and DEP project-alone mean annual breeding adult Sandwich tern combined displacement and collision mortality apportioned to the NNC SPA presented in the **RIAA** (document reference 5.4) is 9.23 (95% CI of 1.00 - 27.77) if design-based density estimates are used by the assessment. This would increase annual mortality in the NNC SPA breeding adult Sandwich tern population by 0.96% (0.10% - 2.88% for the 95% CIs).
67. If model-based density estimates are used by the assessment, the mean annual mortality increases slightly to 11.17 (95% CI of 6.27 - 19.42) (N.B. this describes the

SEP and DEP scenario – refer to the **RIAA** (document reference 5.4) for further details). This would increase annual mortality in the NNC SPA breeding adult Sandwich tern population by 1.16% (0.65% - 2.02% for the 95% CIs).

68. Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. This means that no detectable changes in mortality rates would occur if mean mortality rates generated using design-based density estimates are considered. If the equivalent mean model-based density estimate-derived mortality rates are considered, the predicted annual mortality increase is slightly greater than 1%. However, given that the predicted increase in mortality is only slightly greater than 1%, and considering the highly dynamic nature of Sandwich tern population trends, it is considered that this predicted increase in mortality may also be undetectable against natural variation.
69. It is concluded that predicted Sandwich tern mortality due to the combined effects of operational phase displacement and collision at DEP, SEP, and SEP and DEP would not adversely affect the integrity of the NNC SPA.
70. The confidence in the assessment is high (based on the criteria discussed in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11)). The evidence used to define the CRM input parameters presented in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11) and **Appendix 11.1 Offshore Ornithology Technical Report** (document reference 6.3.11.1) is of high applicability and quality. Whilst there is uncertainty around some of the input parameters, and the avoidance rate, the selected parameters are considered to be sufficiently precautionary based on expert opinion and information drawn from the literature to provide confidence that collision rates are not underestimated, and may in fact be overestimated. Despite not being available in large quantities, the evidence used to set the displacement rates is of high applicability and quality (based on the criteria discussed in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11)). Whilst there is limited available evidence to inform mortality rates, 1% is considered to be sufficiently precautionary based on expert opinion.
71. For the purpose of this compensation document, SNCB guidance is that compensatory measures should be based on the upper 95% CI rates. As such, an annual total mortality for SEP and DEP of up to 28 birds per year is applied to the measures described in **Section 6** below. However, if outputs using model-based density estimates were used, this would reduce to 19 birds per year.

5.1.2.2 In-Combination

72. The in-combination annual breeding adult Sandwich tern combined displacement and collision mortality apportioned to the NNC SPA from all OWFs predicted to have connectivity are presented in the **RIAA** (document reference 5.4). There are various total figures presented dependent upon the macro-avoidance assumption and assumed designs of some of the OWFs included. The estimated annual mortality ranges from 50.4 to 173.6 when the mortality rates for SEP and DEP were calculated using design-based density estimates, and 51.3 to 175.6 when the mortality rates for SEP and DEP were calculated using model-based density estimates. These mortality levels would increase the existing mortality rate of this population by 5.2%

to 18.2%. This magnitude of increase could result in detectable population level effects.

73. Population Viability Analysis (PVAs) investigating the population-level effects of potential displacement impacts for SEP and DEP in-combination with other projects produced a wide range of median Counterfactual of Growth Rate (CGR) and Counterfactual of Population Size (CPS) values depending on the displacement and mortality rates used to estimate the magnitude of the impact.
74. The PVA investigating the population-level effects of potential collision and displacement impacts for SEP and DEP in-combination with other projects produced a median CGR of 0.993 and a CPS of 0.753 at the lower end of the annual mortality predictions after 40 years of operation, or a CGR of 0.976 and a CPS of 0.376 at the upper end of annual mortality predictions. This means that the annual growth rate could reduce by between 0.7% and 2.4% due to in-combination impacts, and after 40 years of operation, the population by 24.7% to 62.4% when compared to the unimpacted baseline.
75. For reference, the annual rate of change in the NNC SPA breeding Sandwich tern population is -2.3%, 0.8%, -0.5% and 2.9% when measured over the last 40, 30, 20 and 10 years respectively. Compared to the 2019 count, the population increase at the NNC SPA has been 21.6%, 27.7%, 7.5% and 22.4% over the last 40, 30, 20 and 10 years respectively. The total predicted collision impacts of all OWFs considered by the in-combination assessment are similar to or larger than changes which have occurred at the colony in the last 40 years.
76. In conclusion, it seems reasonable to assume that since the potential changes at the population level could be larger than the changes that have occurred at the colony over the last four decades, the annual mortalities considered in the PVAs could cause quite substantial population level impacts on the breeding adult Sandwich tern population of the NNC SPA.
77. It is concluded that an adverse effect on the integrity of the NNC SPA cannot be ruled out as a result of predicted Sandwich tern mortality due to collision, and the combined effects of collision and operational phase displacement, at DEP, SEP, and SEP and DEP, in-combination with other OWFs.

5.2 Greater Wash Special Protection Area

5.2.1 Overview

78. The screening process undertaken in the development of **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11) has identified Sandwich tern as being of medium sensitivity to potential collision with operational offshore wind turbines at SEP and DEP, as well as disturbance and displacement during the operational phase of the Projects. This species is considered to be insensitive to disturbance and displacement impacts during the construction and decommissioning phases, and any indirect impacts that may occur as a result of the construction, operation or decommissioning of SEP and DEP.
79. Breeding adult Sandwich terns present at SEP and DEP during the full breeding season (April to August (Furness, 2015)) are assumed to originate from the GW SPA, even though non-breeding adults from a range of breeding colonies are also

likely to be present. In addition, some of the Sandwich terns recorded at SEP and DEP during the breeding season may be sub-adult birds.

80. Outside the breeding season, birds are no longer considered to be members of the GW SPA population. No impacts outside the breeding season are therefore apportioned to this SPA, unlike the NNC SPA.

5.2.2 Quantification of Effect – Collision and Displacement

81. The potential collision risk for Sandwich tern at SEP and DEP was estimated using the Band (2012) collision risk model (CRM). Full details of the input parameters used are provided in the **Appendix 11.1 Offshore Ornithology Technical Report** (document reference 6.3.11.1) of the ES.
82. The potential magnitude of operational phase displacement at SEP and DEP was estimated using the matrix-based approach of UK SNCBs (2017). For this species, displacement and mortality rates of zero to 0.500 and 1% respectively were examined by the assessment. Full details are provided in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11).
83. To generate the worst-case scenarios presented below, it is assumed by the assessment that no macro-avoidance occurs, though evidence from other OWFs indicates that this is not likely. The approach taken to identifying the scale of compensation required is therefore considered to be precautionary.
84. It should also be noted that both design-based and model-based densities were produced for Sandwich tern, and the sections below present assessment outputs using both sets of density estimates.

5.2.2.1 Project-Along (SEP and DEP)

85. The combined worst-case SEP and DEP project-alone mean annual breeding adult Sandwich tern combined displacement and collision mortality apportioned to the GW SPA presented in the **RIAA** (document reference 5.4) is 9.17 (95% CI of 1.00 - 27.46) if design-based density estimates are used by the assessment. This would increase annual mortality in the GW SPA breeding adult Sandwich tern population by 0.95% (0.10% - 2.85% for the 95% CIs).
86. If model-based density estimates are used by the assessment, the mean annual mortality increases slightly to 11.01 (95% CI of 6.21 - 19.03) (N.B. this describes the SEP and DEP scenario – refer to the **RIAA** (document reference 5.4) for further details). This would increase annual mortality in the GW SPA breeding adult Sandwich tern population by 1.14% (0.64% - 1.98% for the 95% CIs).
87. Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. This means that no detectable changes in mortality rates would occur if mean mortality rates generated using design-based density estimates are considered. If the equivalent mean model-based density estimate-derived mortality rates are considered, the predicted annual mortality increase is slightly greater than 1%. However, given that the predicted increase in mortality is only slightly greater than 1%, and considering the highly dynamic nature of Sandwich tern population trends, it is considered that this predicted increase in mortality may also be undetectable against natural variation.

88. It is concluded that predicted Sandwich tern mortality due to the combined effects of operational phase displacement and collision at DEP, SEP, and SEP and DEP would not adversely affect the integrity of the GW SPA.
89. The confidence in the assessment is high (based on the criteria discussed in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11)). The evidence used to define the CRM input parameters presented in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11) and **Appendix 11.1 Offshore Ornithology Technical Report** (document reference 6.3.11.1) is of high applicability and quality. Whilst there is uncertainty around some of the input parameters, and the avoidance rate, the selected parameters are considered to be sufficiently precautionary based on expert opinion and information drawn from the literature to provide confidence that collision rates are not underestimated, and may in fact be overestimated. Despite not being available in large quantities, the evidence used to set the displacement rates is of high applicability and quality (based on the criteria discussed in **ES Chapter 11 Offshore Ornithology** (document reference 6.1.11)). Whilst there is limited available evidence to inform mortality rates, 1% is considered to be sufficiently precautionary based on expert opinion.
90. For the purpose of this compensation document, SNCB guidance is that compensatory measures should be based on the upper 95% CI rates. As such, an annual total mortality for SEP and DEP of up to 28 birds per year is applied to the measures described in **Section 6** below. However, if outputs using model-based density estimates were used, this would drop to 19 birds per year.

5.2.2.2 In-Combination

91. The in-combination annual breeding adult Sandwich tern combined displacement and collision mortality apportioned to the GW SPA from all OWFs predicted to have connectivity are presented in the **RIAA** (document reference 5.4). There are various total figures presented dependent upon the macro-avoidance assumption and assumed designs of some of the OWFs included. The estimated annual mortality ranges from 50.2 to 172.9 when the mortality rates for SEP and DEP were calculated using design-based density estimates, and 51.3 to 174.8 when the mortality rates for SEP and DEP were calculated using model-based density estimates. These mortality levels would increase the existing mortality rate of this population by 5.2% to 18.1%. This magnitude of increase could result in detectable population level effects.
92. PVAs investigating the population-level effects of potential displacement impacts for SEP and DEP in-combination with other projects produced a wide range of median CGR and CPS values depending on the displacement and mortality rates used to estimate the magnitude of the impact.
93. The PVA investigating the population-level effects of potential collision and displacement impacts for SEP and DEP in-combination with other projects produced a median CGR of 0.993 and a CPS of 0.753 at the lower end of the annual mortality predictions after 40 years of operation, or a CGR of 0.976 and a CPS of 0.376 at the upper end of annual mortality predictions. This means that the annual growth rate could reduce by between 0.7% and 2.4% due to in-combination impacts, and

after 40 years of operation, the population by 24.7% to 62.4% when compared to the unimpacted baseline.

94. For reference, the annual rate of change in the GW SPA breeding Sandwich tern population is -2.3%, 0.8%, -0.5% and 2.9% when measured over the last 40, 30, 20 and 10 years respectively. Compared to the 2019 count, the population increase at the GW SPA has been 21.6%, 27.7%, 7.5% and 22.4% over the last 40, 30, 20 and 10 years respectively. The total predicted collision impacts of all OWFs considered by the in-combination assessment are similar to or larger than changes which have occurred at the colony in the last 40 years.
95. In conclusion, it seems reasonable to assume that since the potential changes at the population level could be larger than the changes that have occurred at the colony over the last four decades, the annual mortalities considered in the PVAs could cause quite substantial population level impacts on the breeding adult Sandwich tern population of the GW SPA.
96. It is concluded that an adverse effect on the integrity of the GW SPA cannot be ruled out as a result of predicted Sandwich tern mortality due to collision, and the combined effects of collision and operational phase displacement, at DEP, SEP, and SEP and DEP, in-combination with other OWFs.

6 Compensatory Measures

6.1 Potential Measures Considered

97. Potential compensatory measures for Sandwich tern were considered in an initial review of compensatory measures (**Annex 1A: Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake** (document reference 5.5.1.1)), consulted on with the ETG in March 2021. This built on the measures that had been identified in Furness *et al.*, 2013, which were:
- Closure of sandeel and sprat fisheries close to breeding colonies (i.e. prey enhancement).
 - A range of predator control measures including: eradicate mink; eradicate feral cats; eradicate rats; exclude foxes; control stoats; and exclude large gulls from nesting close to colonies.
 - Protection of colonies from flooding or engineering of new nesting habitat in safer locations (i.e. productivity improvement).
98. From the evidence in Furness *et al.* (2013) and more recent literature, it was considered by the Applicant at this early stage that there were two potential compensatory measures that should be investigated further with respect to delivery by SEP and DEP as project-led measures (with the focus at this stage of the process being on measures that could be delivered at NNC SPA) (see **Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake** (document reference 5.5.1.1) for details). These were:
- Predator control / mortality reduction at NNC SPA: exclude foxes; and
 - Productivity improvement at NNC SPA: protection of colonies from flooding or engineering of new nesting habitat in safer locations.

99. Prey enhancement was also identified as being potentially suitable at this stage, but was not short listed as a project-led measure, recognising that it would need to be delivered as part of a strategic approach led by Government. Despite this, the Applicant has continued to engage with Defra directly and via the OWIC Derogation Subgroup, to further explore how prey enhancement could be taken forward strategically with support from industry. The Applicant also undertook additional work (as summarised below) to provide the ecological evidence base to support the suitability of such measures specifically for Sandwich tern (also see **Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8)).
100. Accounting for feedback received from stakeholders on the potential for each of these measures to be taken forward as compensation for SEP and DEP (see **Annex 1D Record of HRA Derogation Consultation**, document reference 5.5.1.4), the Applicant commissioned a further review of compensation options (**Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2)). This was aimed at supporting an objective evidence based assessment of the emerging compensation proposals and included the measures and topics described in **Table 6-1**:
101. Part of the May 2021 advice received from Natural England in response to the Applicant’s initial review of compensatory measures in March 2021 (see **Annex 1D Record of HRA Derogation Consultation** (document reference 5.5.1.4) included that *“If a robust package of compensatory measures that relate to the impacted SPA cannot be identified, then actions which could benefit the wider network of sandwich tern colonies would need to be considered. It may be that there are locations that have previously held sandwich tern colonies, but no longer do so, due to factors that could be targeted by conservation measures e.g. restoration of lagoon islands, management of disturbance etc. However, we do highlight the need for any such measures to be additional to necessary site management for designated sites, so such measures would need to relate to historically occupied colonies not protected by the existing SPA network.”* For this reason the scope of the further review of compensation options was widened to ensure that potential opportunities outside of NNC SPA were also considered (activities ‘d’ and ‘e’ in **Table 6-1** below).

Table 6-1: Measures and Topics for Sandwich Tern Reviewed in the Sandwich Tern and Kittiwake Ecological Evidence Review

Potential compensatory measure addressed	Activity
Prey enhancement	Review evidence on Sandwich tern diet, with particular reference to birds at NNC SPA.
	Review evidence on likely relationship between prey fish abundance and demography of Sandwich tern (especially productivity).
	Review evidence on sprat and sandeel stocks likely to influence NNC SPA Sandwich tern food availability, the likely impact of fisheries on those stocks, and the feasibility of reducing fishing mortality as a compensatory measure.
	Review the conservation status of Sandwich terns at UK colonies, considering both those that are SPAs and those that

Potential compensatory measure addressed	Activity
Productivity improvement through e.g. predator control, reduced human disturbance, flood protection, vegetation control	are not. This was aimed at informing where the best opportunities might exist to implement measures to increase productivity and, by providing an overview of the UK population status, to indicate locations where there may be opportunity to increase resilience to pressures caused by environmental change.
	Review the broad scope for management measures to increase breeding numbers and productivity of Sandwich terns through predator exclusion, reduced human disturbance, flood protection and/or vegetation control to improve conditions for breeding.
	Review the potential to create a third safe breeding site for Sandwich terns within NNC SPA but away from Scolt Head and Blakeney Point, by habitat improvement measures (perhaps at Stiffkey/Holkham to restore the previous population that clearly did occur in the past). Increasing the number of safe breeding sites within NNC SPA would increase resilience for this important population, but could potentially also allow further increase in breeding numbers.

102. Following consultation with stakeholders on **Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2) (ETG meeting held in January 2022, see **Section 3.2**), the potential for undertaking measures to improve nesting habitat and/or breeding success at a small number of potential locations (including at Scar Point in Loch Ryan, at Farne Islands SPA and at Foulness SPA (see **Annex 2B Sandwich Tern Nesting Habitat Improvements Site Selection**, document reference 5.5.2.2 for further details)) alongside prey enhancement as a potential strategic measure, emerged as the Applicant's preferred options for further development.
103. The compensatory measures were considered in the context of different delivery models, with those of particular relevance to Sandwich tern including both strategic and project-led measures. The delivery models reflect how the Applicant considers each measure could be most feasibly, effectively and proportionately delivered, relative to the Projects' predicted impacts. Of the potential compensatory measures considered further with respect to SEP and DEP:
- Prey enhancement through sandeel stock recovery and sprat stock protection as part of an ecosystem-based management approach is considered by the Applicant to be the most effective means of increasing breeding success and therefore the breeding Sandwich tern population at NNC SPA. This is evidenced by information presented in **Annex 1B: Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2) and **Section 6.3** below. However, as outlined in **Section 6.3.2**, this would necessitate, for example, a decision by Defra to legislate to reduce fishing pressure on sandeels in UK waters as strategic compensation for offshore wind, for which there is currently no agreed mechanism for delivery and which may not be achievable within the necessary timeframes for SEP and DEP. Given the huge potential of such an

action to provide far greater compensation than even the most precautionary estimates of losses incurred due to SEP and DEP and offshore wind in total, prey enhancement is included as a key part of the Applicant's proposals for Sandwich tern compensation, but as a measure that could only be delivered strategically. Nonetheless, an option for the Applicant to pay a financial contribution towards the establishment of prey enhancement as a strategic compensation measure or as an adaptive management measure has been included within the **Draft DCO** (document reference 3.1). Further details with respect to this are set out in **Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8).

- Nesting habitat improvements at Scar Point, Loch Ryan to increase breeding numbers and breeding distribution of Sandwich tern is considered by the Applicant to be the most suitable measure for project-led delivery and is described in detail in **Section 6.4**.

104. In addition, measures specifically to improve breeding success of Sandwich terns have been considered:

- At SPA sites other than NNC (e.g. Farne Islands SPA or Foulness SPA) (**Section 6.5**). These are considered by the Applicant to have merit as project-led measures and are included in the compensation plan as part of an overall package for Sandwich tern. The inclusion of a package of measures, as advocated by stakeholders (see **Annex 1D: Record of HRA Derogation Consultation**, document reference 5.5.1.4), helps to respond to any uncertainties in the delivery or implementation of each of the proposed measures when considered on their own and therefore adds resilience to the overall approach. Measures would be able to be implemented very quickly, particularly at the Farnes, and with a high chance of success, helping to manage any uncertainty in the measures proposed at Loch Ryan either not being successful, or in terms of how long they may take to provide the required level of compensation. The Applicant is continuing to explore potential options at Farne Islands SPA with National Trust and is attempting to engage with the Ministry of Defence (MOD) with respect to Foulness SPA.
- At Blakeney Point within the NNC SPA. In this case the advice from Natural England has been very clear that any measures in this location would not be considered additional to the normal practices required for the protection and management of the site, as they might not provide additional benefit and so would not qualify as compensation (the same is understood to apply to the colony at Scolt Head) (see details in **Table 6-3** and **Annex 1D: Record of HRA Derogation Consultation** (document reference 5.5.1.4)). Whilst National Trust

also recognised challenges around additionality in the April 2022 ETG meeting², feedback regarding the potential benefits of additional support at Blakeney Point was generally more positive with National Trust stating that “*We are constantly evolving our management to deal with changing pressures. We need resource to support that e.g. warden resource, additional funding to enable measures to be implemented more robustly etc.*”

105. In light of feedback from ETG members (specifically Natural England, RSPB and National Trust) and the lack of clear advice and guidance from Defra on navigating current challenges around demonstrating ‘additionality’, the Applicant is considered to have exhausted all potential compensatory options that might benefit NNC SPA Sandwich tern. Natural England, in particular, has been clear that there is no scope for compensation through management of Sandwich tern nesting habitat or predators at Blakeney Point (or Scolt Head which was discounted at an earlier stage) due to challenges around additionality (see **Annex 1D Record of HRA Derogation Consultation** (document reference 5.5.1.4)). Therefore, it has been necessary for the Applicant to explore measures further afield that would benefit Sandwich tern “*outside the affected site*” in accordance with Defra (2021b). A detailed account of the site selection process, informed by stakeholder feedback, which has led the Applicant to consider delivery of compensation for Sandwich tern at Loch Ryan in Scotland (as well as at Farne Islands SPA and Foulness SPA), is provided in **Annex 2B Sandwich Tern Nesting Habitat Improvements Site Selection** (document reference 5.5.2.2).
106. **Table 6-2** provides a summary of the package of compensatory measures proposed by the Applicant for Sandwich tern alongside the intended delivery model. A summary of the measures discounted and the rationale for this is provided in **Section 6.2**.

Table 6-2: Summary of Compensatory Measures for Sandwich Tern and Delivery Model

Measure	Project-led	Strategic
Prey enhancement through sandeel stock recovery and sprat stock protection – ecosystem-based management approach		X
Nesting habitat improvements and restoration of lost breeding range at Scar Point, Loch Ryan	X	
Improved breeding success at SPA sites other than NNC (e.g. Farne Islands SPA or Foulness SPA)	X	

107. As outlined in **Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8), the Applicant has also included within the **Draft DCO** (document reference: 3.1) the option for a contribution to be made to a Strategic Compensation Fund (such as the Marine Recovery Fund) wholly or partly in place of the Applicant’s proposed

² Measures at Blakeney (and Farne Islands SPA) were originally presented as ‘habitat improvement’ but on National Trust’s advice have since been widened to ‘measures to improve breeding success’, recognising that the potential measures are more wide ranging than those that only involve habitat improvement.

measures outlined in **Table 6-2** or as an adaptive management measure. This option has been included in light of the emerging Offshore Wind Environment Improvement Package and Marine Recovery Fund which is expected to provide a viable strategic compensation funding mechanism within the necessary timescales for SEP and DEP and therefore could be relied upon to discharge its derogation requirements. The term 'Strategic Compensation Fund' is used to refer to the Marine Recovery Fund or any other equivalent funding mechanism that may be developed by Defra or an alternative government body for the purpose of delivering strategic compensation.

6.2 Summary of Discounted Measures and Rationale

108. For completeness, **Table 6-3** provides a summary of all of the Sandwich tern measures that have been considered by the Applicant during the pre-application process, but that were discounted, accounting for the feedback received from stakeholders (see **Annex 1D Record of HRA Derogation Consultation**, document reference 5.5.1.4). Further details are also presented in **Annex 2B Sandwich Tern Nesting Habitat Improvements Site Selection** (document reference 5.5.2.2), which describes the site selection process followed for Sandwich tern compensatory measures.

Table 6-3: Sandwich Tern Discounted Measures and Rationale

Measure	Details	Rationale for discounting
Prey enhancement: fishery quota purchase	The Applicant considered the possibility of purchasing fishing quotas as a means of reducing fishing effort on key seabird prey species such as sandeel. This was presented as part of the Applicant's initial review of compensatory measures (Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake (document reference 5.5.1.1)).	Sandeel quota is not held by UK fishing vessels. The ability of the Applicant to purchase fishing quotas would also be dependent on fishermen with appropriate quotas being willing to sell.
Predator control measures at NNC SPA including: eradicate mink; eradicate feral cats; eradicate rats; and control stoats.	-	Not a pressure at NNC SPA
Predator control at NNC SPA: exclude large gulls from nesting close to colonies	Large numbers of gulls may influence colony settlement in spring by Sandwich terns at NNC SPA. Identified as being potentially suitable in the Applicant's initial review of potential compensatory measures for Sandwich tern (Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake (document reference 5.5.1.1)), but not taken forward to the short list.	In their response to the Applicant's initial review (Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake (document reference 5.5.1.1)), Natural England advised that <i>"the main predation concern at Scolt Head arises from Mediterranean gulls rather than large gulls. This species is protected by Schedule 1 of the Wildlife & Countryside Act (1981, as amended), and therefore this measure is not feasible."</i> Additionally, the Applicant considered that gull impacts on terns tend to be low, infrequent/sporadic and difficult to assess, and gull movements/activity can be infrequent/sporadic/opportunistic, so difficult to control.
Predator control at NNC SPA: exclude foxes	Sandwich terns are highly vulnerable to mammal predators and declines at colonies are most often related to an increase in predator access, especially to foxes. Taken forward to the short list in the Applicant's initial review (Annex 1A Initial Review of Compensatory	In their response to the Applicant's initial review (Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake (document reference 5.5.1.1)), Natural England advised that <i>"predator fencing in the form of electric fences are already part of site management measures at both Blakeney and Scolt Head. Therefore, as this option is not</i>

Measure	Details	Rationale for discounting
	<p>Measures for Sandwich Tern and Kittiwake (document reference 5.5.1.1)).</p>	<p><i>'additional' to normal site management, Natural England advises that it cannot be considered as compensation.</i></p>
<p>Productivity improvements at NNC SPA through e.g. reduced human disturbance, flood protection, vegetation control</p>	<p>Sandwich tern breeding success can be affected by flooding, and colony sites may become less suitable over time as vegetation develops, so engineering may allow breeding to continue under optimal conditions.</p> <p>Taken forward to the short list in the Applicant's initial review (Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake (document reference 5.5.1.1)).</p>	<p>In their response to the Applicant's initial review (Annex 1A Initial Review of Compensatory Measures for Sandwich Tern and Kittiwake (document reference 5.5.1.1)), Natural England advised that <i>"Both Scolt Head and Blakeney are part of The Wash and North Norfolk Coast SAC, therefore, natural processes are encouraged at these locations and therefore we wouldn't be able to support this option. Indeed, these dynamic processes are likely to be responsible for the conditions that make the two sites attractive to sandwich tern."</i></p> <p>Reduced human disturbance and vegetation control were discounted as a compensatory measure as not considered additional to the normal practices required for the protection and management of the site.</p>
<p>Measures to improve breeding success at Blakeney Point, NNC SPA</p>	<p>As described in Section 6.1 and in the rows above, whilst Natural England has not supported measures proposed within NNC SPA due to additionality issues, engagement with National Trust has suggested that there is opportunity to support existing management activities at Blakeney.</p>	<p>Discounted as a compensatory measure as not considered additional to the normal practices required for the protection and management of the site.</p>
<p>Restoration / creation of a third site within NNC SPA</p>	<p>Create a third safe breeding site for Sandwich terns within NNC SPA but away from Scolt Head and Blakeney Point, by habitat improvement measures (perhaps at Stiffkey/Holkham to restore the previous population that clearly did occur in the past). Increasing the number of safe breeding sites within NNC SPA would increase resilience for this important population, but could potentially also allow further increase in breeding numbers.</p>	<p>Discounted on the grounds of:</p> <ul style="list-style-type: none"> - Uncertainty as to whether this option would represent compensation (i.e. whether this measure would contribute new birds to the population or just cause existing birds to move site); - There being no evidence to suggest that breeding numbers are constrained by limited nesting habitat at Blakeney or at Scolt Head; - Potential adverse implications for the existing breeding colonies at Scolt Head and Blakeney Point;

Measure	Details	Rationale for discounting
		<ul style="list-style-type: none"> - The need to understand the issues that led to the abandonment of historical nesting activity and how these would be managed if this was taken forward as compensation; - Uncertainty as to whether an additional site would be successfully colonised and used in the future; - Uncertainty in how an additional site would be established, maintained and subsequently managed in the long term; and - This was understood to already be under consideration by RSPB and the Norfolk Coastal Partnership.
<p>Nesting habitat improvements at Scar Point, Loch Ryan – restoration of the original island</p>	<p>Restoring the original island by engineering could be achieved by placing rock-filled gabions around the periphery and then infilling with rock and a surface of gravel to provide nesting habitat well above wave action height.</p>	<p>It was recognised by both the Applicant and in feedback from stakeholders in ETG meetings (see Annex 1D Record of HRA Derogation Consultation, document reference 5.5.1.4) that relatively large scale engineering works would be required to achieve restoration of the island, the design would be less readily adapted in the event that modifications were required to encourage nesting and therefore there were concerns about overall feasibility and potential impacts on the existing environment of the loch. As such, this option was not taken forward.</p>

6.3 Prey Enhancement through Sandeel Stock Recovery and Sprat Stock Protection – Ecosystem-Based Management Approach

6.3.1 Overview

109. A literature search shows that sandeels *Ammodytes* spp. and clupeids (especially sprats *Sprattus sprattus*) are the main breeding season food of Sandwich terns in north-west Europe (MacArthur Green, 2021). The relative importance of these prey types varies from year to year, almost certainly in relation to relative abundance of the stocks. There is also consistent evidence of clupeids being more important as chicks get larger but sandeels being more important when chicks are small (MacArthur Green, 2021). There is some evidence indicating that Sandwich terns tend to forage on clupeids close to the colony and along the coast but may commute further offshore to forage on sandeels over sandbanks, possibly especially when tidal flow brings sandeels closer to the sea surface. Strong winds inhibit foraging by Sandwich terns and may influence their choice of foraging area and prey species (MacArthur Green, 2021).
110. Studies at North Norfolk Coast show that Sandwich terns breeding here feed chicks predominantly on sandeels and sprats but that adult terns may feed themselves on a wider range of foods including crustaceans and larval fish as well as sandeels and sprats (Perrow *et al.*, 2010, 2011, 2017).
111. Sandwich tern foraging effort and breeding success are strongly influenced by food availability (Stienen *et al.*, 2015, Fijn *et al.*, 2017), with adult body condition at colonies where forage fish are scarce being reduced by high breeding effort, suggesting that shortage of forage fish probably affects adult survival as well as colony breeding success (Stienen *et al.*, 2015).
112. Food shortage has been implicated as a cause of reduced productivity at several of the main UK Sandwich tern colonies (Furness *et al.*, 2013). Considering the situation in eastern Scotland when the sandeel stock collapsed after heavy fishing mortality had been imposed, Frederiksen and Wanless (2006) concluded that ‘Sandwich terns may have been affected by reduced sandeel availability during the 1990s in a similar way to black-legged kittiwakes’, suggesting a likely impact of reduced abundance of sandeels on adult survival as well as on breeding success, a view supported by the conclusions of Stienen *et al.*, (2015).
113. These studies which have been reviewed in greater detail in **Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2) provide evidence that measures to increase abundance of sandeels, sprats and juvenile herring in waters near to Sandwich tern colonies can be expected to result in an increase in breeding success, and probably an increase in adult survival, of Sandwich terns.
114. This conclusion is also supported by Ecopath-Ecosim ecosystem modelling (Bayes and Kharadi 2022) which concluded that a closure of the sandeel fishery in the North Sea would lead to a 40% increase in the biomass of the sandeel stock and a 42% increase in the number of seabirds within the first 10-15 years after closure of the sandeel fishery (Bayes and Kharadi 2022). This modelling did not separate gains for Sandwich tern from gains for other seabirds, but since Sandwich tern is

particularly reliant on forage fish (as a surface-feeding seabird with limited foraging range and high proportion of forage fish in the breeding season diet) the gains for this species are likely to be greater than for the average “seabird”.

115. This conclusion is also supported by the Consultation Outcome summary of responses published by Defra (2022) which stated that the introduction of new restrictions in the sandeel fishery *“could lead to positive ecological impacts by allowing these stocks to recover and support the health of the rest of the marine ecosystem”* with *“the bounce back of healthy fish, seabird and marine mammal populations”*.
116. Measures that result in an increase in abundance of sandeels, sprats and juvenile herring in waters near to Sandwich tern colonies can therefore be considered to be targeted and likely to be effective.
117. Fishing on sandeels is one of the main factors that reduces the abundance of sandeels in the North Sea (Lindegren *et al.*, 2018 and reviewed in **Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2).
118. Briefly, Lindegren *et al.*, (2018) estimated that sandeel spawning stock abundance in International Council for the Exploration of the Sea (ICES) Sandeel area 1r (which is the area that includes North Norfolk Coast) would have been at least twice as high as it has been if fishing mortality had been maintained at about half the level that it was. They estimate that reducing effort on this stock now would lead to an increase in sandeel abundance, although they caution that recovery might be incomplete. Sandeel management in the North Sea aims to avoid reducing spawning stock biomass (SSB) below a threshold at which future reproduction of sandeel might be compromised but does not aim to keep sandeel biomass above the threshold needed to support good breeding success of dependent seabirds such as Sandwich tern (and kittiwake). As a result, in recent years, sandeel SSB in ICES sandeel area 1r has been well below the ‘one-third for the birds’ threshold identified by Cury *et al.*, (2011) as a basis for ecosystem-based management (Cury *et al.* (2011) used empirical evidence from several seabird-fishery interactions around the world to suggest that management should aim to keep food fish stocks such as sandeels above a threshold of one-third of their historical maximum biomass in order to achieve good productivity among dependent seabird populations).
119. In reviewing this fishery management and implications for seabirds, **Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2) concluded that continuation of sandeel fishing under existing ICES management advice is likely to have an adverse impact on Sandwich tern numbers and demography at colonies in the east of England. This is consistent with evidence reviewed by MacArthur Green (2022) which concluded that *“Recent research emphasises the specialist diet of Sandwich tern, and the importance of high densities of small pelagic fish near to colonies if this species is to breed successfully”* and that recent research *“strengthens the evidence that measures to increase abundance of sandeels and sprats in waters near to Sandwich tern colonies can be expected to result in an increase in breeding success and probably an increase in adult survival of Sandwich terns”*.

120. The recently published ICES report on sandeel stocks in the North Sea (ICES, 2022a) provides clear evidence that management of this fishery is putting at risk not only the sandeel stock as a sustainable resource, but also dependent predators in the ecosystem such as sandeel-dependent seabirds. In 2021, ICES advised that the sandeel total allowable catch (TAC) in ICES 1r should be less than 5,464 tonnes and the TAC agreed was 5,351 tonnes (ICES, 2022a). However, the catch taken was 16,944 tonnes (ICES, 2022a), nearly three times the size of the agreed TAC. This failure to comply with established TAC limits is unexplained in ICES (2022). The short-term forecast of the latest stock assessment is that even fishing mortality of zero in 2022 will result in the SSB being below the minimum precautionary limit of spawning stock biomass considered by ICES to be capable of still producing adequate numbers of young fish (B_{pa}). On that basis a TAC of zero should be set. However, despite the depletion of this stock in 2021, ICES recommend a catch of 5,000 tonnes in 2022 to ensure that further monitoring of the stock biomass is possible. There is no explanation of why 5,000 tonnes is required to permit monitoring, but the fishing in excess of the appropriate TAC in 2021 and setting a TAC 5,000 tonnes above the limit that is considered to risk damage to stock recruitment risks further depletion and failure of the depleted spawning stock to produce future cohorts.
121. There is a major sprat stock in the North Sea which supports a fishery that can be large. The main part of this stock and fishery is in the south-east North Sea. The catch has been around 200,000 tonnes per year in recent years (2014-2020) from a stock with a SSB around 200,000 to 350,000 tonnes in 2014-2020 (ICES, 2021). The total North Sea and Skagerrak-Kattegat catch varies from year to year and was as low as 68,900 tonnes in 2013, and as high as 303,300 tonnes in 2015. However, following unusually high fishing mortality imposed on this stock in 2020 and 2021, the spawning stock biomass fell to 100,495 tonnes in 2022, the lowest abundance for over 13 years (ICES, 2022b).
122. Most of this stock is well outside the foraging range of breeding Sandwich terns from colonies on the north Norfolk coast. However, there are local populations of sprats in various coastal areas, often in estuarine locations. Those populations may be tenuously linked with the main sprat stock in the south-east North Sea or may be independent stocks (ICES, 2018; 2021). Sprat abundances can be particularly high in these small areas of inshore estuarine habitat, as reported by Johnson *et al.*, (1982) who found densities in the Outer Thames and the Wash 10 to 200 times higher than found in the open sea. Sprat abundance peaks in the Thames Estuary in mid-winter (Power *et al.*, 2000) and supports a local fishery (Colclough *et al.*, 2002). Similarly, sprat abundance can be high inshore along the Suffolk coast in winter, where it supports a local fishery, and the tidal movements over coastal sandbanks can make sprats available at the surface to flocks of kittiwakes and other gulls (Dare and Read, 2007). This tidal effect is also likely to influence sprat availability to Sandwich terns in summer. ICES (2018; 2021) note that there is a risk that exploitation of local sprat stocks may be unsustainable, and certainly cannot be managed with the existing stock assessment and quota setting system for the North Sea as a whole. UK fishermen typically catch between 500 and 3,500 tonnes of sprat per year, representing only about 1% of the catch taken in total from the North

Sea sprat stock (typically about 80% to 90% of the catch being taken by Danish boats), but with much of the UK catch taken from local coastal stocks of uncertain size or dynamics (ICES, 2021). Although the fishery targets sprats, it includes a bycatch of juvenile herring which can vary in quantity by region, so can represent a mixed fishery on sprat and herring (ICES, 2021).

123. MacArthur Green (2021) reviewed the literature relating to sprat stocks, fisheries and ecological relationships with dependent predators such as terns. The depletion of the sprat population in the Firth of Forth, concomitant decline in tern breeding numbers, and recovery of sprats and terns after the termination of that local fishery provides a useful example of how management of local sprat populations can influence tern conservation, as are changes in sprat and tern populations in the Clyde. MacArthur Green (2021) concluded that local stocks of sprats in coastal areas of east England and east Scotland may be especially important for breeding Sandwich terns. Reductions in fishing pressures on sprat stocks would be expected to result in an increased breeding success, and probably increased adult survival of Sandwich terns. However, the evidence supporting this is much less strong than the evidence supporting the gains that could be expected from reducing fishing impact on sandeel stocks.

6.3.2 Delivery mechanism

124. Key stakeholders (Natural England and RSPB) engaged through the Projects' EPP, have expressed significant support for tackling the pressure on seabird prey resources as a form of compensation for offshore wind. This is not only reflected in **Annex 1D Record of HRA Derogation Consultation** (document reference 5.5.1.4) also within submissions from interested parties during examination and determination of the Hornsea Project Three, Norfolk Vanguard, Norfolk Vanguard, East Anglia One North and Two DCOs.
125. Closing sandeel fisheries has also been proposed by Berwick Bank Offshore Wind as a compensation measure (BBC 2022, SSER 2022). According to BBC (2022) SSE stated "*We think that it's important that we manage the sandeel fisheries carefully to allow enough prey for the seabirds and to allow for offshore wind development, which is key to addressing the climate emergency which also sits behind the decline in seabird numbers. We recognise that there might be an impact from an offshore wind farm on birds but we know that the bigger impact is caused by climate change*".
126. It has also been raised in relation to the Hornsea Project Four DCO examination with Natural England stating that "*Natural England have long held the view that a primary pressure acting on English seabirds is the reduction in prey availability associated with commercial fisheries targeting forage fish (notably sandeels). A number of reviews have concluded that improving prey availability is likely to be the most effective way of compensating for offshore wind impacts on seabirds. However, forage fish management is highly complex, and an ecosystem-based approach is needed to safeguard sufficient prey resources for seabirds, whilst reducing the risk of unintended consequences (e.g. pressure on other fisheries). Nevertheless, improving the amount of prey remains the single strategic measure*

most likely to deliver significant benefits [to FFC SPA] seabird populations.” (Natural England, 2022). As described above, the same can be considered to apply to NNC and GW SPA Sandwich tern.

127. As outlined by Natural England, it is widely accepted that this measure would be most effectively delivered by Government on a strategic basis. The Applicant considers the most effective way this could be achieved would be to restrict fishing on sandeel, sprat or juvenile herring in UK waters. However, this would need to be implemented either by Defra in the case of sandeel or the relevant Inshore Fisheries and Conservation Authority in the case of sprat and juvenile herring fisheries within UK inshore waters.
128. An alternative approach could be for the Government to negotiate with ICES to adopt ecosystem-based management that recognises threshold abundances of forage fish needed to sustain dependent predators. This would replace the current management which is for ICES to advise on appropriate quotas for sandeel, sprat and herring harvest based on the objective of not depleting SSB below ‘ B_{lim} ’ which is the SSB below which future recruitment becomes increasingly at risk. Adopting ecosystem-based management that recognises threshold abundances of forage fish needed to sustain dependent predators has been advocated for forage fish fisheries globally, including North Sea sandeels (e.g. Hill *et al.*, 2020). However, for species such as sprat, there is no clear evidence of the threshold abundance needed to sustain dependent predator populations. The analysis undertaken by Cury *et al.*, (2011) found that this threshold was around one-third of the maximum biomass for a wide range of different forage fish species and stocks and different seabird species. That would suggest the implementation of a ‘one-third for the birds’ control rule, as advocated by Hill *et al.*, (2020) would be a reasonable approach.
129. Creating a change in ICES policy would require international agreement and therefore may be difficult to achieve. Thus, it is the Applicant’s view that the most suitable option available to the Government would be to impose fishing restrictions in UK waters.
130. Given the acknowledged and significant potential of such an action to provide far greater compensation than even the most precautionary estimates of losses incurred due to SEP and DEP and offshore wind in total, prey enhancement measures could form a valuable part of the compensation proposals for SEP and DEP, but as a measure that could only be delivered strategically. Nonetheless, an option for the Applicant to pay a financial contribution towards the establishment of prey enhancement as a strategic compensation measure has been included within the **Draft DCO** (document reference 3.1). Further details with respect to this are set out in **Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8).

6.4 Nesting Habitat Improvements and Restoration of Lost Breeding Range at Scar Point, Loch Ryan

6.4.1 Overview

131. The Applicant followed the draft Defra guidance (2021b) on selecting compensatory measures and sites. Site selection is described in detail in **Annex 2B Sandwich Tern Nesting Habitat Improvements Site Selection** (document reference 5.5.2.2). The process was informed by a review of the conservation status of Sandwich terns at all UK colonies, both within and outside of existing SPAs (**Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2). This review was used in consultation with stakeholders to provide the evidence base to help guide the further development of the compensatory measures for Sandwich tern.
132. The JNCC SMP database holds very few counts of numbers of Sandwich tern pairs at non-SPA sites. Since 2000, only 16 sites are listed in England, Wales and Scotland, and only five of these sites held more than 50 pairs of Sandwich terns in any year between 2000 and 2021. The Applicant was not able to identify any sites near to NNC SPA where there appear to be good prospects of success in restoring a Sandwich tern colony at a non-SPA site. At consultation meetings, stakeholders, including Natural England and RSPB, were also unable to suggest any suitable locations (see **Annex 1D: Record of HRA Derogation Consultation** (document reference 5.5.1.4)).
133. Forrester *et al.* (2007), noted 31 sites in Scotland where Sandwich terns bred in the past but had abandoned the site before the 2000s, and only seven sites in Scotland still used by Sandwich tern for breeding in the early 2000s. At least four of those seven sites have been abandoned since the 2000s (JNCC, 2021), leaving only Sands of Forvie, Forth Islands, and St John's Pool Caithness, as continuing to hold regular Sandwich tern breeding colonies.
134. There is, therefore, considerable potential to manage sites in Scotland to increase breeding numbers and breeding distribution of Sandwich tern. One site from which Sandwich terns have been lost is Scar Point, Loch Ryan, Wigtownshire (Furness *et al.*, 2013). That is a site in southwest Scotland which, if restored, would significantly improve the geographical coherence of the Sandwich tern breeding range in Britain and Ireland.
135. The JNCC Seabird Monitoring Programme database (JNCC, 2021) records that there were no Sandwich terns nesting at Scar Point, Loch Ryan (54.968°N, 5.061°W), in 2021, and that there was "*low vegetation on spit above high tide, area of shingle above high tide significantly reduced compared to map*". There are no data recordings for 2007 to 2020. However, there were 24 pairs in 2006, 20 pairs in 2005, 45 pairs in 2004 (JNCC, 2021). There were 120 pairs in 1998 (JNCC, 2021). Restoring Sandwich terns to nesting in Loch Ryan would not only provide compensation by increasing breeding numbers but would also have the very strong qualitative merit of restoring former breeding range of this species which has been lost. Although Sandwich terns nested at several sites in west Scotland in the past, all of those colonies have been lost. Restoring one of the sites in west Scotland

would therefore be strategically valuable for restoration of lost breeding ranges rather than just increasing breeding numbers.

136. Information from the local Bird Recorder for Dumfries and Galloway, Paul Collin, quotes:

“I moved to the area in 1984, at which point a small colony of breeding terns at the Scar existed. I was told they were seldom successful, the thought that rats were probably the main cause was mooted. The site is a raised shingle spit which in 1984 had a low point halfway down, at high tide forming a large shingle island perhaps 150m x 30m. I put up some signs asking people not to go beyond a rope line from May to July and the colony quickly expanded with great success. I think people and dogs were perhaps the cause of previous failures. It was a brilliant tern colony with common terns nesting on the high tide wrack line, Arctic and Sandwich on the higher ground with Sandwich dominating the poorly vegetated highest ground and up to 9 little terns mainly confined to the NE side of the island. Intrusion by dog walkers and fishermen was a common problem. Large ferries located at Stranraer sailed passed regularly creating a dangerous wash which at times overtopped the whole island, causing losses and almost certainly erosion, although erosion on a northerly wind is an ongoing natural process. The situation was probably exacerbated by the introduction of high speed ferries. There were cases of people getting washed off their feet from unexpected waves from the ferries and also concerns of increased erosion. Ferries finally relocated to Cairnryan, possibly reducing some of these issues, but in many respects it was too late because by the early 2000s terns had virtually abandoned the site and the shingle ridge/peninsula had been much reduced. The role which vessels had in the erosion process and how much of it was natural could be long debated.”

137. According to Bell *et al.* (2000) the island in Loch Ryan on which terns nested disappeared during the 1960s-70s as a result of local gravel extraction combined with additional erosion pressures caused by high-speed ferries operating from Stranraer adding to natural processes. It is understood that there are now speed restrictions in place so that the latter should no longer be an issue. Scottish Government’s Dynamic Coast programme identifies likely slight further loss of the small remaining shingle spit as a result of climate change impacts between now and 2050, but predicts only slight change to this coastline.

138. This site clearly has potential to hold breeding Sandwich terns. It seems that a combination of erosion of the former island off the point of the shingle spit, flooding of the shingle spit, and encroachment of vegetation onto the shingle, together with high levels of human disturbance, has resulted in the loss of Sandwich terns from this site.

139. Given the large increase in sprat abundance in the Clyde in recent years (Lawrence and Fernandes 2021) and the large increase in Sandwich terns seen at nearby Machrihanish Bird Observatory in recent years, this site appears to be a good option for encouraging re-colonization by Sandwich terns, through a combination of engineering, vegetation control and predator exclusion. If this were to happen, it would also fill a significant gap in Sandwich tern breeding distribution. Although there are 11 sites in the west of Scotland where Sandwich tern has been recorded

to breed in the past, nine of these sites were abandoned before 2007 (Forrester *et al.*, 2007), and both the sites still used in 2007 (which included Scar Point, Loch Ryan), have now been abandoned (JNCC, 2021).

140. There is strong evidence that Sandwich terns frequently seek new breeding sites and will move from their established breeding colony to another when environmental conditions encourage this (Courstens and Fijn, 2020). There is therefore good reason to expect that providing new nesting opportunities at Loch Ryan will be likely to attract re-colonization by Sandwich terns. This is exactly what was seen when an artificial site was created at St John's Pool, Caithness, which has since been colonized by Sandwich terns (**Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2)).
141. The birds at St John's Pool originated from many different Sandwich tern colonies from The Netherlands, England, Scotland and Ireland (**Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2)). The same can be expected at Loch Ryan. Since there seems to be frequent nonbreeding by adult Sandwich terns (Courstens and Fijn, 2020), provision of this new breeding opportunity is likely to increase the proportion of the population that chooses to breed rather than drawing breeding birds away from other established colonies.
142. Tracking studies, including at Sands of Forvie colony, show that breeding Sandwich terns generally forage in sheltered coastal waters (Perrow *et al.*, 2011; Wilson *et al.*, 2014; Perrow *et al.*, 2017). They depend on sandeels and sprats to feed chicks. The sprat stock in the Clyde Sea Area is at a high level (Lawrence and Fernandes, 2021), providing a strong prey resource for terns, but there seems to be a shortage of suitable nesting habitat preventing Sandwich tern recovery in west Scotland. Providing a nesting site in Loch Ryan would appear to fill that gap, without harm to any other interests.
143. A major benefit of this compensation measure is to recover lost breeding range of Sandwich tern. Restoring Sandwich tern breeding in the west of Scotland will not only allow growth in breeding numbers in the population as a whole, but also provides greater resilience by spreading the breeding distribution over a wider geographical area. This helps to counter the long-term trend of Sandwich tern nesting in fewer sites with an increasing proportion in just two or three large SPA populations. It will therefore help to reduce the high vulnerability of Sandwich tern to potential catastrophic impacts on the sites holding high proportions of the entire population. In this sense the measure goes beyond the requirement to maintain the coherence of the network (see **Section 2.2**) by significantly improving and *restoring* the geographical coherence of the Sandwich tern breeding range in Britain and Ireland.

6.4.2 Delivery Mechanism

144. The Applicant considers that there are two potential delivery mechanisms for the nesting habitat improvements and restoration of lost breeding range at Loch Ryan. These are:
 - Anchor a floating structure (pontoon) off the coast a short distance from the original island; or

- Create an inland pool ('lochan') a short distance from the original island.
145. A pontoon would reduce the amount of change to the sea bed and coastline that might result from an engineered restoration of the island, and would be less vulnerable to changes in the future and easier to adapt (if necessary) and manage. Although it is uncertain whether Sandwich terns would choose to colonize a pontoon (as common terns have in other locations), no attempts have been made to make this possible and so the lack of evidence is due to a lack of tests rather than to Sandwich terns failing to colonize such a structure. Installing a pontoon would be relatively simple to achieve from an engineering perspective.
146. The creation of an inland pool meanwhile would follow the successful model adopted at St John's Pool, Caithness (creation of a small lochan with islands of gravel and sand for terns to nest, the pool being protected by a fox-proof fence). Sandwich terns have colonized the islands created in St John's Pool, Caithness, where they had not previously bred, and so there is good reason to believe that this would also be successful in restoring a breeding colony of Sandwich terns at Loch Ryan. Creating such a pool would be relatively straightforward to achieve in engineering terms, although it would require agreement with the relevant land owner/s and would require planning permission (see [Section 6.4.8](#)).
147. Natural England and RSPB have both indicated through the ETG meetings (see [Annex 1D Record of HRA Derogation Consultation](#) (document reference 5.5.1.4)) a preference for the inland pool option and so the Applicant intends to progress this as the preferred option. However, in order to account for the various uncertainties associated with each, the Applicant considers it appropriate at this point in time to keep both options open (i.e. the pontoon and the inland pool), although only one of the options would be required to be delivered, since either is considered to be capable of providing the required scale of compensation ([Section 6.4.3](#)).

6.4.3 Scale

148. Compensation required would be to increase Sandwich tern numbers by more than the equivalent of the upper 95% CI of ca. 28 adults (mean ca. 9 adults) estimated to be killed by the development each year during operation (see [Section 5](#)). There is uncertainty about whether or not Sandwich terns would recolonize Loch Ryan if provided with restored breeding habitat, and how quickly this may occur. If Sandwich terns did recolonize then it is likely that there could be around 120-150 pairs nesting there (as there were in the 1990s before the island was destroyed by gravel extraction and erosion, and similar in number to the situation at St John's Pool, Caithness where about 120 pairs of Sandwich terns now nest). However it is unclear how many Sandwich terns the local ecosystem can support, and numbers might well increase far above that number.
149. Not only would 120-150 pairs be likely to produce about 100 chicks per year (equivalent to about 38 adults) but the restoration of Sandwich tern breeding in the west of Scotland would help to recover the former breeding range of this species in the UK. Both these effects would help to maintain the UK SPA suite for this feature as Sandwich terns frequently move between breeding sites so the UK population

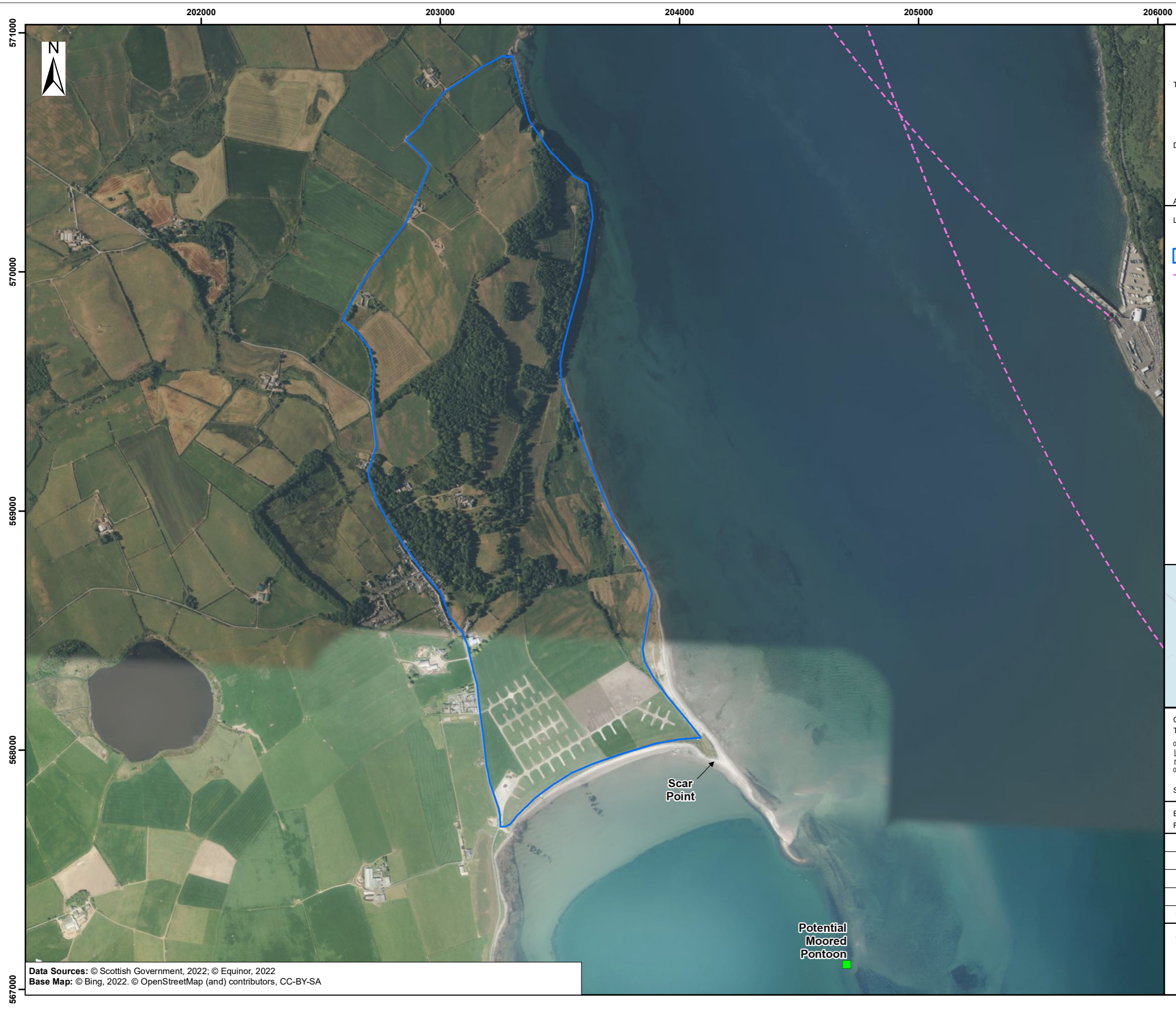
represents a meta-population with inter-dependent colonies. It is impossible to equate the conservation gain from recovery of breeding range (which is considered by the Applicant to be very substantial at a qualitative level) to a specific number of terns killed by collision and displacement as a result of SEP and DEP. However, in terms of resilience of the population, the restoration of lost breeding range would represent a major achievement.

150. Sandwich terns do not necessarily increase in breeding numbers if provided by larger areas of nesting habitat. For example, in the Lagoon of Venice, over 700 pairs of Sandwich terns nest on a dredge-spoil island of 0.08 hectare (Valle and Scarton (2021)), which is one of the smaller islands in that lagoon but is attractive to Sandwich terns because it lacks dense vegetation cover and is remote from human disturbance by being surrounded by tidal flats. Similarly, Sandwich terns (of a different but closely-related subspecies) in Texas and North Carolina prefer small dredge-spoil islands for nesting. Over 700 pairs nest on Big Foot Slough Island near Ocracoke, an island of less than 0.1 hectare (Ocracoke Observer 2018). According to Tom McGinnis (in litt.) "*Sandwich terns nest in dense colonies on small isolated dredge spoil islands in North Carolina*". The Cornell Laboratory of Ornithology states in online Birds of North America "*Fortunately this species responds readily to the creation of artificial nesting habitat such as dredge-spoil islands*". At Cape Fear River, 3,000 pairs nest on an island of three acres (1.2 hectares) in a freshwater environment. In the Netherlands, some Sandwich tern colonies are also on very small islands. According to Kees Camphuysen, seabird expert in the Netherlands who lives in Texel, factors determining colony site selection by Sandwich terns are not very well understood (but clearly include low cover by vegetation, lack of mammal predator access, lack of human disturbance), but the size of the islands may not be an important factor; some in the Netherlands used by Sandwich terns are very small. For example in Texel Sandwich terns nest on De Petten on an island of about 50m by 5m, at De Putten (north of Camperduin) they nest on an island of about 120m by 10m, and at Wagejot they nest on an island about 10m in diameter (Kees Camphuysen, in litt). Nevertheless, the intention is to design a pool with islands that has potential to be expanded if that appears to be desirable, and that is surrounded by buffer land that limits risk of birds at the pool being disturbed by human activity.
151. The outline design details for the inland pool or pontoon required to achieve this scale of compensation are provided in **Section 6.4.5**. Either the inland pool or pontoon could be readily adapted to increase the scale of compensation should this be required (**Section 6.4.7**). Adaptive management could be to increase the size of the pool and number of islands if the evidence indicated that breeding numbers of birds were being constrained by the size of the created habitat.
152. As stated above, it is recognised that Sandwich tern recolonization at Loch Ryan may not occur even though the inland pool and pontoon appear to be suitable for this species. Therefore, and as set out in **Section 6.1**, this measure is presented as one part of an overall package alongside the strategic compensation option for prey enhancement as detailed in the **Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8), as well as the deployment of tern nest boxes and shelters at Farne

Islands SPA (or suitable measures at Foulness SPA) to improve breeding success. Measures proposed at the Farne Islands can be implemented effectively during any time lag between wind farm development and colonisation of the Loch Ryan site by Sandwich terns, so that any 'deficit' could be avoided through immediate compensation actions at the Farne Islands.

6.4.4 Location

153. An inland pool would ideally be excavated in the agricultural land immediately north of Scar Point close to the shore of Loch Ryan and close to the former nesting site. This is an area of agricultural land used for rough grazing and, as a rural area, has a low level of human activity and therefore a low risk of disturbance. It may also be possible to locate the inland pool elsewhere along the west shore of Loch Ryan. An area of search for this purpose is shown on **Figure 6-1**, although this area may be expanded as necessary to enable the selection of an optimum location from an ecological perspective whilst accounting for any constraints such as those related to land ownership, existing land use and other activities, and nature conservation designations (see **Annex 2B Nesting Site Habitats Improvements Site Selection** (document reference: 5.5.2.2)) for further information.
154. A floating pontoon would be located in Loch Ryan close to the west shore of the loch off Scar Point. A potential location for the structure is shown on **Figure 6-1**, on which the Applicant has consulted with Crown Estate Scotland (see **Annex 1D Record of HRA Derogation Consultation** (document reference 5.5.1.4)). The exact position will be determined at the detailed design stage, accounting for water depth and suitability for a permanent sea bed anchorage, any other relevant considerations at the time and in consultation with relevant stakeholders (e.g. Crown Estate Scotland). The potential location is slightly further off the current tip of Scar Point than the original island used to be, with this greater distance thought to be preferable to reduce human disturbance to birds on the structure and to ensure that it would be floating at all stages of the tidal cycle. This location is away from the local native oyster fishery on the east side of the loch and is also distant from ferry routes (see **Section 6.4.9** for further details).



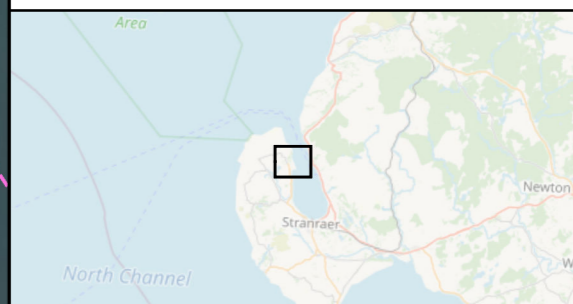
Sheringham Shoal and Dudgeon Extension Projects

Title:
Figure 6-1 Inland Pool Area of Search and Potential Location of Pontoon at Loch Ryan

Document:
Habitats Regulation Derogation:
Provision of Evidence

Application Doc. no.: 5.5

- Legend:
- Potential Moored Pontoon Location
 - Inland Pool Area of Search
 - Ferry Route



Coordinate Reference System: British National Grid
Transformation WGS84: OSGB_1936_To_WGS_1984_7

Scale: 1:15,000 Scale at size: A3

Equinor Doc. no.: C282-RH-Z-GA-00013
RHDHV Doc. no.: PB8164-RHD-ZZ-ON-DR-Z-0176

REV	DATE	STATUS	DRW	CHK	APR
A	14/06/2022	First Issue	FC	LA	AP



Data Sources: © Scottish Government, 2022; © Equinor, 2022
Base Map: © Bing, 2022. © OpenStreetMap (and) contributors, CC-BY-SA

Scar Point

Potential Moored Pontoon

6.4.5 Outline Design Details

155. The Applicant considers that the design of the inland pool should be based on the example of St John's Pool, Caithness and experience of Sandwich terns nesting on dredge-spoil islands created in Lagoon of Venice and in sites in North Carolina and Texas. Regard has also been given to some 'broad design principles' provided by the RSPB ahead of the June 2022 ornithology compensation ETG meeting (see [Annex 1D Record of HRA Derogation Consultation](#) (document reference 5.5.1.4)). The design of the inland pool would therefore include the following:

- A pool of at least 80m diameter containing two or three islands of at least 15m diameter, encompassing a total area (water and islands) of at least 1 hectare (10,000m²). The pool would also be surrounded by a buffer of land that would ensure minimal human disturbance to birds at the pool. While a larger pool and more or larger islands would make this site of greater value for biodiversity enhancement, there is little evidence to suggest that a larger pool or larger islands would increase the likelihood of Sandwich terns recolonizing. In many locations Sandwich terns have chosen to nest on very small islands, with the key features being lack of human disturbance, lack of access for mammal predators and lack of vegetation in areas where the birds nest but some cover nearby that protects chicks from avian predators. On this basis, a buffer area surrounding the pool that keeps human disturbance away from the colony is considered more important than size of pool or islands. At St John's Pool over 100 pairs of Sandwich terns nest on a small pile of sand just 100m², together with 20 pairs of common terns, two or three pairs of Arctic tern and 30 pairs of black-headed gulls (Hughes *et al.*, 2021). Provision of several small islands in a pool would give scope for attracting similar numbers of Sandwich terns to the numbers that were present in the 1990s (for example 120 pairs in 1998). The size of the pool would be designed in order to accommodate any potential need in the future to increase the area of islands within it, as part of the adaptive management approach described in [Section 6.4.7](#).
- The pool and the islands within it would have irregular edges with mounds of gravel or sand, to give birds a choice of substrates and positions in relation to the water.
- Water depths between the islands within the pool would be up to approximately 1.5m.
- Predator-proof electric fencing surrounding the entire perimeter (which would be in the order of 600m in length).

- Appropriate measures to feed the pool with water and, if considered necessary, to provide aeration. It may be possible to construct a freshwater pool, using water from the Corsewall Burn for example to maintain the level in the pool. However, another option may be to construct a pool with the water level maintained by tidal valves with a pipe connection to the sea in Loch Ryan. A decision on this element of the design will be informed by land agreement considerations during the detailed design stage (see [Section 6.4.8](#)).
156. A floating pontoon structure would be at least 30m by 20m in order to provide sufficient nesting habitat and stability, with the floating pontoon moored to a sea bed anchorage (leased from Crown Estate Scotland). The structure would not need to be rectangular, but that might be the simplest design to develop.
 157. The sides of the pontoon would be designed to prevent mammals from climbing out of the water onto the pontoon, to make the nesting site safe from predators such as American mink, rats and otters and safe from disturbance by marine mammals such as seals. The sides would be designed to minimise spray from wave action, for example sheet metal angled to overhang the water.
 158. The surface would be covered with a layer of gravel to provide the nesting surface preferred by Sandwich terns. Provision of nest box terraces, as on the Isle of May, would help to ensure protection against predation by gulls or crows and would provide shelter against exposure to direct sunshine and rain. Consideration will be given to having the structure divided into subsections with low walls that would provide cover/shelter for tern chicks. The surface will be designed to provide free drainage of rainwater off the pontoon to ensure that nests cannot be waterlogged during heavy rain.
 159. It may be desirable to install a ring of floats around the pontoon to discourage people from attempting to land on the pontoon from pleasure boats or kayaks and to reduce wave action reaching the sides of the pontoon. Interpretation boards should be put on the shore walk at Scar Point to provide information about the purpose of the structure and the importance of avoiding disturbance to nesting birds. Signs should be placed on each side of the pontoon to request that people keep off the pontoon and avoid disturbance to birds.
 160. In the case of both the inland pool and the pontoon, appropriate facilities to maximise the value and benefits to the local community and visitors to the area will be considered. For example interpretation boards to provide information and minimise disturbance, and bird hides.
 161. It may also be possible to use playback of Sandwich tern colony sounds and model birds to help attract Sandwich terns to nest on the inland pool islands or pontoon. Such options will be further investigated in the detailed design phase.
 162. The final design details and specifications will be confirmed through consultation with stakeholders in the development of the Sandwich tern CIMP.

6.4.6 Timescales

6.4.6.1 Timescale to Achieve Compensation

163. As previously stated, there is no certainty that Sandwich terns will nest on a newly created site immediately and it may take several years for nesting numbers to build up. As such, the pool or pontoon will be installed as soon as possible after the proposed compensation has been agreed through the Sandwich Tern CIMP and prior to the operation of any turbine forming part of the authorised development (see details in **Section 6.4.8**). This will allow Sandwich terns time to find the structure and subsequently build up numbers.
164. As described in **Section 6.4.3**, if Sandwich terns did recolonize then it is likely that there could be around 120-150 pairs nesting, producing about 100 chicks per year (equivalent to about 38 adults). Increasing the scale of compensation could be used to offset any accumulated deficit that might result whilst nesting numbers build up, although the need to do so would need to be balanced against the very strong qualitative merit of restoring former breeding range of this species. Such flexibility is a key benefit of the proposed measure, whereby relatively straightforward adjustments can be made to the scale of compensation, which will be confirmed through the suggested programme of monitoring and adaptive management and agreed with the Sandwich Tern Compensation Steering Group (STCSG), as set out in **Section 6.4.7**.

6.4.6.2 Other Timing Considerations

165. The works, whether the installation of an inland pool or pontoon will be undertaken where possible at a time of year (e.g. June-July) to minimise any temporary disturbance to local shorebird and waterfowl populations. Undertaking the works outside the winter months will also help to minimise any issues with adverse weather and ground conditions.

6.4.7 Monitoring, Maintenance and Adaptive Management

166. Numbers of terns nesting on the inland pool islands or pontoon will be monitored each May-June, for the operational lifetime of SEP and DEP. It would be preferable to do this using a drone to photograph the birds present, following best practice as recommended by Spaans *et al.* (2018) and by Valle and Scarton (2021). This should also allow monitoring of breeding success achieved by the birds. There would be an opportunity to adapt the compensatory measure if monitoring suggested that this was necessary. Numbers of nest boxes on the pontoon could be increased, as could the size of the pontoon or islands (by addition of further modular sections of pontoon or increased area of islands). In the event that recolonization does not occur, further adaptive management measures could include, as necessary, consideration of other project-led measures that would benefit Sandwich tern or the delivery of compensation through a strategic delivery model, as set out in **Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8).

167. The Applicant will engage with all relevant parties in the finalisation of the Sandwich Tern CIMP to agree the details of the monitoring and maintenance programme. Monitoring results will be shared with the STCSG on an annual basis and any requirement for adaptive management measures will be agreed with the group.
168. In terms of ongoing management requirements, the inland pool or pontoon will be maintained for the operational lifetime of the authorised development. In the case of the inland pool, ongoing maintenance activities will include maintenance of the predator proof fence, upkeep of any installed bird hides, removal of vegetation and any measures necessary to maintain water levels and water quality. The gravel nesting surface on the pontoon would be replaced or replenished as necessary and nest box terraces maintained on an annual basis.
169. The Applicant also recognises that this project will provide valuable learning about habitat creation for wetland birds and therefore the lessons learned, especially in relation to any requirements for adaptive management, will be made available through publication of the experiences gained and shared with the relevant industry and stakeholder groups (see **Section 4.4 of Strategic and Collaborative Approaches to Compensation and Measures of Equivalent Environmental Benefit** (document reference 5.8)).

6.4.8 Outline Implementation and Delivery Roadmap

170. The steps that will be followed by the Applicant to implement and deliver the nesting habitat improvements are as follows:
- Prior to the consent being granted, consultation will be undertaken as required with all relevant stakeholders who are expected to be participants of the STCSG. The STCSG will be formally established once consent has been granted to oversee the development, implementation, monitoring and reporting of the compensation. Core members of the STCSG, depending on the option taken forward, will include the MMO, Marine Scotland, Natural England, NatureScot, and Dumfries and Galloway Council. The RSPB will also be invited to participate. Other stakeholders that will be consulted and kept informed on an ongoing basis include, depending on the option taken forward, Crown Estate Scotland, local conservation groups, local ornithologists, the local fishermen in Loch Ryan, ferry operators and recreational boating interests.
 - As set out in **Section 6.4.6**, it is proposed to secure the nesting habitat improvements (regardless of the option taken forward) so that they are constructed and available for colonization by Sandwich terns prior to the operation of any turbine forming part of the authorised development. However, the Applicant will look to implement compensation as soon as possible after the proposed measures have been agreed through the Sandwich Tern CIMP. The exact timescale will be agreed with relevant stakeholders, including any implications for the scale of compensation required to account for when measures can be put in place.

- Detailed design of the nesting habitat site improvements will be undertaken in line with the outline design information set out in **Section 6.4.5**, informed through consultation with relevant stakeholders. The detailed design process will include consideration of the potential impacts from the implementation of the measure as set out in **Section 6.4.9**. Relevant stakeholders will be consulted on these, including how to avoid, reduce or mitigate any adverse impacts, and to maximise the beneficial impacts.
- Initial engagement with Marine Scotland has indicated that a marine licence will be required to enable the installation and maintenance of a pontoon. A sea bed lease for the pontoon will also be required along with a Marine Works Consent from Crown Estate Scotland. Planning permission will be required in order to construct and maintain an inland pool as well as a controlled activity regulations licence from the Scottish Environment Protection Agency (SEPA) for abstraction/impounding of water. Subject to the design of the inland pool (and if any works are required below mean high water springs which might be necessary if the pool is fed via water from the loch), a marine licence from Marine Scotland and a Marine Works Consent and sea bed lease from Crown Estate Scotland would also be required (subject to any relevant exemption applying). The application/s will be submitted to the appropriate authority once the preferred option has been selected and the design of that option has been progressed. Given the proposed size of the pontoon and the indicative location for implementation of this measure (see **Section 6.4.4**), the Applicant considers that this structure would not amount to a material interference with the public right of navigation and thus, no additional legal consent would be required with respect to this.
- Discussions with relevant landowners are underway to secure land or rights to deliver nesting habitat improvement measures at Loch Ryan, Scotland. The Applicant will provide PINS with a further update on the progress of these discussions following DCO application submission.
- The detailed delivery proposals for the agreed compensatory measures will be set out in the Sandwich Tern CIMP, which will be produced post-consent, based on the outline version provided with the DCO application (**Annex 2A Sandwich Tern Outline Compensation, Implementation and Monitoring Plan**, document reference 5.5.2.1) and which must be submitted to the SoS for approval in accordance with the **Draft DCO** (document reference 3.1).
- The success of the compensatory measures will be monitored in line with the details described in **Section 6.4.7**, with the results provided to the STCSG on an annual basis to allow for discussion and feedback and to inform any requirement for adaptive management.

- Any amendments to or variations of the approved Sandwich tern CIMP must be in accordance with the principles set out in this Sandwich Tern Compensation Document and may only be approved where it has been demonstrated to the satisfaction of the SoS that they are unlikely to give rise to any materially new or materially different environmental effects and that the required level of compensation will continue to be delivered.
 - The nesting habitat improvements will remain in place and be maintained for the operational lifetime of the authorised development if they are colonised, and routine and adaptive management measures and monitoring will continue whilst the measures are in place. Given the nature of the measure and the potential for significant additional benefits to be accrued (see [Section 6.4.9](#)), consultation will be undertaken with the STCSG in the final few years of wind farm operation, to help determine the most appropriate course of action for onward management and maintenance of the site. As outlined in the [Draft DCO](#) (document reference 3.1), the compensation measures will not be decommissioned without written approval from the SoS in consultation with the relevant SNCB.
171. An outline roadmap for the implementation and delivery of the nesting habitat improvements is provided in [Table 6-4](#) with the purpose of showing the key activities that would be undertaken and in what order. The dates provided are indicative at this stage as the timings of key project activities and milestones, e.g. consent award, FID, construction and start of operation have not yet been set.

Table 6-4: Outline Roadmap for the Implementation and Delivery of the Loch Ryan Nesting Habitat Improvements

Year from consent	Indicative calendar year based on current project timeline	Activity	2022	2023	2024	2025	2026	2027	2028
Pre-consent	2022 – 2023	Development of compensation proposals in consultation with ETG and stakeholders, including for example design details and site selection							
Pre-consent	Q3 2022	SEP and DEP DCO application submitted, including Sandwich Tern Compensation Plan (this document) and Outline Sandwich Tern CIMP							
Pre-consent	Q3/Q4 2022	Ongoing engagement with statutory and non-statutory stakeholders (who are expected to be participants of the future STCSG), and other relevant stakeholders, to help mature proposals pre-consent							
Pre-consent	Q1/Q2 2023	Progress concept design of nesting habitat improvements (inland pool and/or pontoon) in consultation with stakeholders. Carry out any necessary site surveys.							

Year from consent	Indicative calendar year based on current project timeline	Activity	2022	2023	2024	2025	2026	2027	2028
Pre-consent	Q3 2023	Selection of preferred option (inland pool or pontoon)							
Pre-consent	Q2-Q4 2023	Obtain any necessary agreements with landowners, planning permissions, consents and licenses for the implementation of the measure/s							
Pre-consent	Q2-Q4 2023	Detailed design of the preferred option							
Year 0	Q1 2024	Anticipated SEP and DEP consent granted							
Year 0	Q1 2024	Formally establish STCSG							
Year 0	2024	Submission to SoS of Sandwich Tern CIMP							
Year 0	2024	Approval of Sandwich Tern CIMP							
Year 1	2025	Fabrication (where relevant)							
Year 1	Summer 2025	Installation							
Year 2	2026 breeding season	Start of compensation Implement annual programme of monitoring and adaptive management							

Year from consent	Indicative calendar year based on current project timeline	Activity	2022	2023	2024	2025	2026	2027	2028
		including annual review with STCSG							
Year 3	2027 breeding season (and each year thereafter)	Continue compensation and annual programme of monitoring and adaptive management							
Year 3	2027	Start of offshore construction at the wind farm sites							
Year 4	2028	Earliest first power at SEP and DEP							

6.4.9 Consideration of Potential Impacts from Implementation of the Compensation Measure

172. Consideration has been given to any potential impacts that might arise as a result of the implementation of the Loch Ryan nesting habitat improvements. The potential impacts identified are described in **Table 6-7** together with details, where relevant, of how these would be avoided, reduced or mitigated (or maximised in the case of beneficial impacts).

Table 6-5: Potential Impacts from Implementation of the Loch Ryan Nesting Habitat Improvements

Potential impacts	Details	Measures required to avoid, reduce or mitigate
Disturbance to local native oyster beds and/or fishing activity from the installation and presence of a pontoon structure	NatureScot Sitelink V3 shows that Loch Ryan and its shores have no protected area designations. However, the loch holds one of the most important native oyster populations in the UK (UMBS 2007) and supports a local native oyster fishery, the only remaining native oyster fishery in Scotland (Eagling <i>et al.</i> , 2015). The oysters favour the east side of the loch, where the substrate is sand and gravel. The west side is muddier and holds few oysters. The former island was on the west side, which is away from most of the oyster habitat. The potential location for the pontoon is close to Scar Point, on the west side of Loch Ryan so is distant from the main oyster beds in Loch Ryan and the main fishing area.	N/A
Disturbance of existing ferry routes and recreational boating activity from the installation and presence of a pontoon structure	The potential location is distant from ferry routes and is in shallow water where such a structure is unlikely to represent a navigation hazard to boats using Loch Ryan. Recreational boats (including sea kayaks and paddle boards) may have to travel marginally further around the pontoon if transiting along the west shore of Loch Ryan.	N/A
Disruption to users of recreational routes including Public Rights of Way (PRoW)	Potential for disturbance of users of recreational routes will be limited given the inland pool option is likely to be situated in an area of agricultural land. There would be no permanent closures of any recreational routes.	Disruption to any recreational routes will be managed to ensure continued safe access for members of the public, and all efforts will be made to minimise any temporary closure durations as a result of the installation works. The exact management method will be agreed in advance with the relevant local authority and included in the relevant management plan.
Temporary disturbance to local shorebird and waterfowl populations from installation	The installation of an inland pool or pontoon would cause some temporary disturbance to local shorebird and waterfowl populations.	Undertake works at a time of year (e.g. June-July) to minimise any impact. Interpretation boards put on the shore walk at Scar Point or at the inland pool to provide information about the purpose of the scheme and the importance of avoiding disturbance to nesting birds.

Potential impacts	Details	Measures required to avoid, reduce or mitigate
Permanent footprint on the sea bed from pontoon anchorage	The sea bed anchorage of a pontoon would have a small but permanent footprint on the sea bed, however the site is not within a protected area.	N/A
Run-off of nutrient rich water from pontoon impacting water quality	Run-off of nutrient rich water from an inland pool with tidal exchange or a pontoon could occur. The amount of nutrient input into Loch Ryan from a tern colony and any other birds that may be present would be considerably less (several orders of magnitude less) than that from agricultural land in the loch catchment area. Inputs from terns would be limited to the tern breeding season, which is relatively short (May-July). Dilution of nutrients by tidal flow of the seawater through Loch Ryan would be rapid.	N/A
Beneficial impacts for local bird biodiversity	The presence of an inland pool or pontoon would be strongly beneficial for local bird biodiversity as it would provide a safe roosting site for shorebirds and waterfowl which can be present in large numbers in autumn, winter and spring. It would be unlikely to have any adverse impacts on any local bird populations.	N/A
Beneficial impacts from amenity value of inland pool or pontoon	The inland pool or pontoon would have an amenity value benefiting both the local community and visitors to the area.	The Applicant will investigate any opportunities to maximise amenity value during the design process and through further consultation with relevant stakeholders prior to construction. Examples of opportunities that will be investigated include the provision of information boards for educational purposes and a bird hide from which members of the public could observe birds using the pool or pontoon without causing disturbance.
Change in land use	Construction of an inland pool with islands in agricultural land north of Scar Point would alter an area of pasture land into a pond with islands that would most likely be used by a range of shorebirds and waterfowl as a roosting and feeding site throughout the year, as well as by nesting shorebirds such as ringed plovers and oystercatchers, and possibly by black-headed gulls, common terns and little terns as well as by Sandwich terns. This would provide a local biodiversity gain, both with respect to bird	N/A

Potential impacts	Details	Measures required to avoid, reduce or mitigate
	<p>populations but also other fauna and flora associated with wetland habitat. It is difficult to identify any adverse effects that such a pool would have on any other receptors. Terrestrial birds that use open pasture land, such as pipits, pied wagtails and skylarks, would most likely gain from the increased abundance of insects that could be expected at a pond added to what is currently dry agricultural rough pastureland.</p>	
<p>Local employment opportunity</p>	<p>Experience from St Johns Pool suggests that the scope of the necessary management activities as outlined in Section 6.4.7 would merit delivery through the creation of a dedicated warden/site manager role, providing a local employment opportunity.</p>	<p>N/A</p>

6.5 Improved Breeding Success at SPA Sites other than NNC – Farne Islands SPA

6.5.1 Overview

173. The breeding numbers of Sandwich terns have increased at NNC SPA ([Section 4.1](#)) and breeding success there has been consistently high in recent years. This makes it very difficult to identify any possible compensatory measures that could be implemented at NNC SPA. Furthermore, it is generally less than ideal that any one site should hold a high proportion of the entire UK population of a bird of conservation concern, as a population more widely spread across its breeding range will be more robust than a population highly concentrated at a single site. In the 1990s, NNC SPA held about 34% of the Great Britain SPA population of Sandwich terns (3,457 out of 10,107 pairs), and in the 2000s about 38% (2,980 out of 7,932 pairs) (Stroud *et al.*, 2016). However, this SPA now holds about 4,850 out of about 9,000 pairs (54%) (JNCC SMP database). This increase from 34% to 54% of the population breeding in a single SPA makes the population less resilient and more vulnerable to potential local catastrophic unpredictable events. This strengthens the case for efforts to focus on sites away from NNC SPA. Not only have Sandwich terns declined at many SPA sites away from NNC SPA, but they have declined even more at non-SPA sites, with an increasing and now very high proportion of the entire UK population of this species breeding within SPAs ([Annex 1B Sandwich Tern and Kittiwake Ecological Evidence](#) (document reference 5.5.1.2)).
174. The evidence review presented at [Annex 1B](#) found that Foulness SPA has been deserted by Sandwich terns since the late 1990s, with deterioration of nesting habitat coupled with predation by foxes identified as the cause (as confirmed in email correspondence from Natural England and RSPB following the June 2022 ETG meeting, see [Annex 1D Record of HRA Derogation Consultation](#), document reference 5.5.1.4). No management measures put into effect at this site have yet allowed Sandwich terns to resume breeding, although it seems possible that fences to exclude foxes might be a suitable conservation measure to deploy at this site, subject to the provision of suitable dedicated resources to achieve this. The email correspondence from Natural England following the June 2022 ETG meeting further advised that “...*whilst there may be some potential future management options at Foulness around e.g. beneficial use of dredge arisings [to help provide nesting habitat safe from predation], this is likely to require considerable design and modelling work to achieve. In terms of delivery, this is therefore best considered as a medium-to-long-term option, and therefore perhaps not that suited to a project-specific compensatory measure.*”
175. Whilst the possibility of implementing compensatory measures at Foulness SPA has not been completely discounted by the Applicant at this stage, the Project has not been able to progress matters through engagement with the MOD. As such this section focuses on Farne Islands SPA, which the Applicant has been able to discuss with stakeholders including Natural England, RSPB and National Trust through the ETG meetings as well as through targeted consultation with National Trust, who manages the site (see [Annex 1D Record of HRA Derogation Consultation](#) (document reference 5.5.1.4)).

176. The evidence review presented at **Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2) found that Sandwich tern breeding numbers have declined considerably at Farne Islands SPA (**Plate 6-1**) and that decline relates in part to long-term increases in vegetation density and height in the area used by breeding terns and possibly to impacts of predation by large gulls. There is no evidence of food shortage being the main driver of breeding numbers as the numbers breeding at nearby Coquet Island SPA have remained stable over the period of the decline at the Farne Islands and birds from these two colonies will share a similar food resource along this part of the Northumberland coast (**Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2)). Whereas habitat management at Coquet Island has been successful in maintaining good nesting habitat for Sandwich terns, this has apparently not been the case at the Farne Islands. This decline has persisted since the 1990s, despite attempts to halt the decline through management at the Farnes.

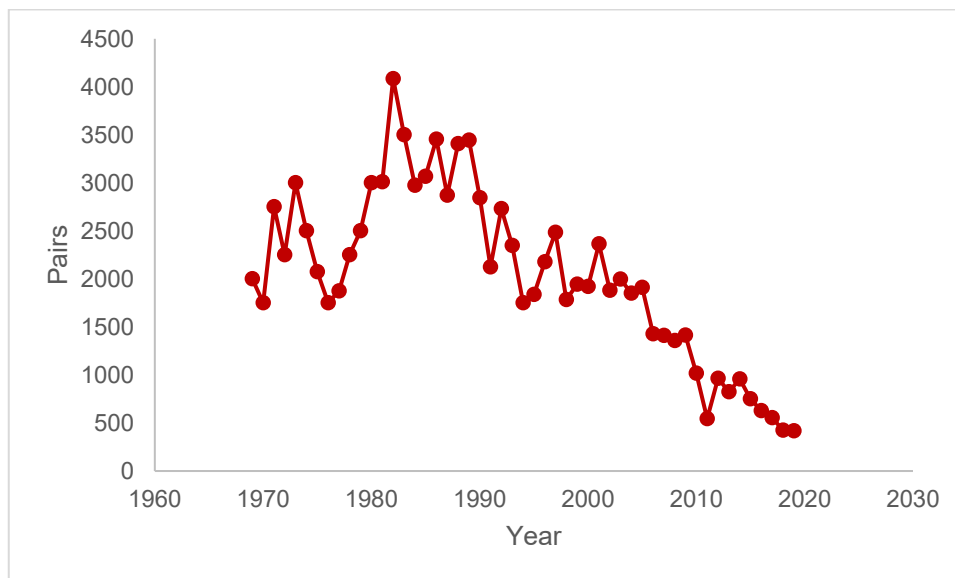


Plate 6-1: Numbers of Pairs of Sandwich Terns Nesting at Farne Islands SPA 1969-2021 (Data from JNCC 2021) Downloaded 31/8/2021.

177. Given the Farne Islands is an SPA for breeding Sandwich terns, any plans to carry out compensation actions at this location would need to be additional to normal management of that SPA. This is slightly problematic because the most recent Management Plan expired in March 2021 and it has yet to be updated. The Applicant understands that it is now with Natural England for approval but is not yet a public document. However, discussions with National Trust indicate what is likely to be potentially additional to the forthcoming management. Sandwich tern breeding numbers have declined considerably on the Farnes over many years, and that decline seems likely to be influenced mainly by deteriorating habitat quality for Sandwich tern nesting in terms of vegetation height and density, and impacts of predators on tern eggs and chicks. The forthcoming Management Plan aims to improve vegetation management to try to recover Sandwich tern breeding numbers. During early informal engagement with National Trust on the Plan it was confirmed

that this does not include deployment of tern nest boxes and shelters that have been used successfully at Isle of May (Steel and Outram 2020) and does not include deployment of cameras to monitor tern nesting and any attempts at predation of tern nests. Both of these measures therefore can be considered ‘over and above’ management of this SPA and therefore are additional measures that can provide compensation. Discussions with National Trust are ongoing to further inform the Applicant’s proposal with respect to Farne Islands SPA.

6.5.2 Delivery Mechanism

178. Subject to agreement with National Trust, the Applicant will deploy tern nest boxes and shelters at Farne Islands to improve breeding success of Sandwich terns at that site. Cameras will be deployed to monitor tern nest and chick survival and to identify attempted predation and successful predation events in order to help future management to identify measures to minimise these impacts. If predation impacts from large gulls are found to still be a threat to terns after this work, bamboo canes will be installed to inhibit gulls from hunting over the tern colony, as used effectively elsewhere (Steel and Outram 2020). Use of bamboo canes to reduce predation of terns by large gulls is advocated by RSPB as tern conservation best practice (Babcock and Booth 2020). Since the Sandwich tern population at the Farne Islands is part of a meta-population (Courstens and Fijn 2020; **Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2)) these measures will help to protect the integrity of the SPA suite for breeding Sandwich tern in the UK.

6.5.3 Scale

179. Compensation required would be to increase Sandwich tern numbers by more than the equivalent of the upper 95% CI of ca. 28 adults (mean ca. 9 adults) estimated to be killed by the development each year of operation (**Section 5**). Gains in terms of increases in numbers of Sandwich terns would be likely to be much larger than that number. There were over 2,000 pairs and up to 4,000 pairs of Sandwich terns nesting on the Farnes in most years from 1969 to 2000 (**Annex 1B Sandwich Tern and Kittiwake Ecological Evidence** (document reference 5.5.1.2); and **Plate 6-1**), so the sustainable population of this species is clearly over 2,000 pairs. The population has declined to below 500 pairs, so the scope for recovering this population is considerable.
180. In the first instance it is proposed to deploy 400 nest boxes and 400 shelters. Deployment of six cameras should allow a representative sample of nests to be monitored to record predation attempts by large gulls.
181. It is anticipated that this approach will allow Sandwich tern breeding numbers on the Farne Islands to increase by a considerably larger amount each year than the precautionary estimate of 28 adults needed per year. For example, if 100 of the 400 nest boxes were used by Sandwich terns it would be reasonable to expect losses of eggs to be reduced by 25% compared to the present situation (because 100 pairs represent about 25% of the current breeding numbers). Chick shelters can be expected to reduce depredation of chicks by at least 50% for this population based

on evidence in Steele and Outram (2022) and Babcock and Booth (2020a,b) that chick shelters allow chicks to avoid predation by large gulls which are considered to be the main cause of chick loss at the Farne Islands. This would be predicted to increase chick production at a colony of 400 pairs by at least 100 chicks per year in the first instance, and by larger numbers on average as the population numbers recover towards their historical level of several thousand pairs.

182. However, if nest and chick predation continue to inhibit population growth bamboo canes will be installed at a subset of locations to provide quantitative evidence of the increase in breeding success that results from deployment of canes. Previous tests of this have demonstrated that attacks by large gulls are reduced by about 50% so a similar gain can be anticipated from deployment of canes. However, if nest boxes and shelters are effective then there may be no extra benefit from deploying canes, and better results (where this is considered necessary) may be achieved from adding further nest boxes and/or shelters rather than deployment of canes.

6.5.4 Location

183. This work will be carried out at Farne Islands SPA, within the area preferred by Sandwich terns for nesting. Detailed site selection to confirm the exact location/s would be undertaken in consultation with National Trust taking into account local constraints and other ecological and practical considerations.

6.5.5 Outline Design Details

184. Nest box terraces and tern shelters will be installed following the successful design deployed on the Isle of May (Steel and Outram 2020). These boxes and shelters are manufactured from marine ply or recycled plastic, based on a design first developed for roseate tern nesting at Coquet Island and Rockabill (Babcock and Booth 2020a). Nest boxes are approximately 45 cm by 30 cm and 15 cm high, with a full height 15 cm wide door and either a flat or sloping roofed design (see images and further details in Steel and Outram 2020; and Babcock and Booth 2020a). The exact design is considered less important than the clustering of boxes and lack of disturbance (Babcock and Booth 2020a). Recycled plastic boxes may have a longer life-span than boxes made from marine ply so have been considered more suitable by RSPB (Babcock and Booth 2020a). At the Isle of May, hundreds of boxes have been made by volunteers attending young birders' training courses (Steele and Outram 2020) and similar possibilities may exist for the Farne Islands. Wooden "apex" shelters are placed on the ground near to more exposed nests to provide chicks with protection from large gulls and weather (Steele and Outram 2020). Nest boxes are placed in rows on shingle/gravel substrate (so called "tern terraces" Steele and Outram 2020). Cameras will be installed in tern breeding areas to monitor breeding success and any attempted predation attacks. Camera systems will be mounted on metal poles with video transmitted to a solar-powered battery driven base station where recorded video will be stored. Stored recordings will be taken at intervals through the breeding season for analysis, with cameras placed to determine which parts of the colony are exposed to most attacks by large gulls and

how well the nest boxes and shelters (and canes if canes are also deployed) perform in reducing gull attacks and success rates of attacks.

185. The final design details and specifications will be confirmed through consultation with stakeholders in the development of the Sandwich tern CIMP.

6.5.6 Timescales

6.5.6.1 Timescale to Achieve Compensation

186. Nest box terraces and tern shelters will be installed before SEP and DEP become operational. Evidence from the Isle of May is that terns start to use the nest boxes in the first season they are made available, but that numbers using the boxes build up over the first few years. Sandwich terns start to breed when three years old (Horswill and Robinson 2015). However, JNCC (2020) note that “*The population fluctuates dramatically among years due to large variations in the proportion of mature birds attempting to breed and distribution varies owing to mass movements between colonies*”. This suggests that site-seeking birds will be highly likely to make use of nest boxes as soon as these are provided, allowing an increased number of immature and nonbreeding adult birds to recruit into the colony. The gain to the population is therefore likely to be immediate, though increasing in scale over the first few years after nest box deployment.

6.5.6.2 Other Timing Considerations

187. Nest box terraces, tern shelters, camera systems and (if necessary) and bamboo canes will be installed before the Sandwich terns arrive at the Farne Islands in spring, in order to avoid any disturbance to the terns.
188. Further information on the timescales for implementation and delivery of the compensation are provided in **Section 6.5.8**.

6.5.7 Monitoring, Maintenance and Adaptive Management

189. High uptake of nest boxes by terns is anticipated at the Farne Islands, and a significant boost to their breeding numbers and breeding success, as found at the Isle of May (Steel and Outram 2020). Tern breeding numbers and breeding success have been monitored each year by National Trust wardens on the Farne Islands and this is likely to continue (with funding support provided by the Applicant as appropriate), so will measure the effectiveness of the nest boxes and shelters. It is anticipated that analysis of the video (which may include analysis of tern diet brought to nests, feeding trip durations, predation events and breeding success) will most likely be carried out by student projects and/or by citizen science volunteers with suitable training and oversight provided. If the videos show that predation impacts on terns remain a concern after deployment of tern nest boxes and shelters, further measures will be considered to reduce that impact. These include possible deployment of bamboo canes to inhibit large gulls from hunting over the tern colony. Canes make it more difficult for large gulls to hunt for tern chicks over the colony but do not impede the much more agile adult terns (Steel and Outram 2020). Boothby *et al.* (2019) showed that canes around tern nests on the Farnes reduced the

numbers of gull attacks on terns by half compared to the rate in control areas without canes. Babcock and Booth (2020b) describe deployment of canes at tern colonies as tern conservation best practice, but suggest that further quantification of the benefits would be useful. Alternatively, deployment of chicken wire fences around the perimeter of the tern colonies could be used to prevent access by oystercatchers which can also be predators on terns, and to prevent tern chicks from wandering into dangerous areas (Steel and Outram 2020).

190. The Applicant will engage with all relevant parties in the finalisation of the Sandwich Tern CIMP to agree the details of the monitoring programme. Monitoring results will be shared with the STCSG on an annual basis and any requirement for adaptive management measures will be agreed with the group.
191. In terms of ongoing management requirements, it is expected that these will be incorporated, through agreement with National Trust, under the existing management processes at the Farne Islands (with funding support provided by the Applicant as appropriate). Ongoing management activities are expected to include maintenance and replacement where necessary of the nest boxes and shelters, installation and maintenance of the camera system each spring, and installation and maintenance of any predator control measures such as bamboo canes or chicken wire fencing.

6.5.8 Outline Implementation and Delivery Roadmap

192. The steps that will be followed by the Applicant to implement and deliver the measures to improve breeding success at the Farne Islands are as follows:
 - Prior to the consent being granted, consultation will be undertaken as required with all relevant stakeholders who are expected to be participants of the STCSG. The STCSG will be formally established once consent has been granted to oversee the development, implementation, monitoring and reporting of the compensation. Core members of the STCSG for the purpose of measures at the Farne Islands will include the MMO, Natural England and National Trust. The RSPB will also be invited to participate.
 - As set out in [Section 6.5.6](#), it is proposed to implement the measures prior to the operation of any turbine forming part of the authorised development. However, the Applicant will look to implement compensation as soon as possible after the proposed measures have been agreed through the Sandwich Tern CIMP.
 - Detailed specification of the measures will be undertaken in line with the outline design information set out in [Section 6.5.5](#), informed through consultation with relevant stakeholders. This process will include consideration of the potential impacts from the implementation of the compensation as set out in [Section 6.5.9](#). Relevant stakeholders will be consulted on these, including how to avoid, reduce or mitigate any adverse impacts, and to maximise the beneficial impacts.

- Since the measures will be delivered alongside the existing management of this SPA by working with National Trust, no specific additional licences or permissions are anticipated to be required by the Applicant.
 - The detailed delivery proposals for the agreed compensatory measures will be set out in the Sandwich Tern CIMP, which will be produced post-consent, based on the outline version provided with the DCO application (**Annex 2A Sandwich Tern Outline Compensation, Implementation and Monitoring Plan** (document reference 5.5.2.1)) and which must be submitted to the SoS for approval in accordance with the **Draft DCO** (document reference 3.1).
 - The success of the compensatory measures will be monitored in line with the details described in **Section 6.5.7**, with the results provided to the STCSG on an annual basis to allow for discussion and feedback and to inform any requirement for adaptive management.
 - Any amendments to or variations of the approved Sandwich tern CIMP must be in accordance with the principles set out in this Sandwich Tern Compensation Document and may only be approved where it has been demonstrated to the satisfaction of the SoS that they are unlikely to give rise to any materially new or materially different environmental effects and that the required level of compensation will continue to be delivered.
 - The measures will remain in place and be maintained for the operational lifetime of the authorised development if they are colonised, and routine and adaptive management measures and monitoring will continue whilst the measures are in place. As outlined in the **Draft DCO** (document reference 3.1), the compensation measures will not be decommissioned without written approval from the SoS in consultation with the relevant SNCB.
193. An outline roadmap for the implementation and delivery of the measures to improve breeding success at Farne Islands SPA is provided in **Table 6-6** with the purpose of showing the key activities that would be undertaken and in what order. The dates provided are indicative at this stage as the timings of key project activities and milestones, e.g. consent award, FID, construction and start of operation have not yet been set.

Table 6-6: Outline Roadmap for the Implementation and Delivery of the Measures to Improve Breeding Success at Farne Islands SPA

Year from consent	Indicative calendar year based on current project timeline	Activity	2022	2023	2024	2025	2026	2027	2028
Pre-consent	2022 – 2023	Development of compensation proposals in consultation with ETG and stakeholders							
Pre-consent	Q3 2022	SEP and DEP DCO application submitted, including Sandwich Tern Compensation Plan (this document) and Outline Sandwich Tern CIMP							
Pre-consent	Q3/Q4 2022	Ongoing engagement with statutory and non-statutory stakeholders (who are expected to be participants of the future STCSG) to help mature proposals pre-consent							
Pre-consent	Q1/Q2 2023	Progress concept design of measures to improve breeding success i.e. of the specific locations to implement the measures, and the design of the nest boxes, shelters and camera system. Carry out any necessary site surveys.							
Pre-consent	Q2-Q4 2023	Detailed specification of the measures							
Year 0	Q1 2024	Anticipated SEP and DEP consent granted							

Year from consent	Indicative calendar year based on current project timeline	Activity	2022	2023	2024	2025	2026	2027	2028
Year 0	Q1 2024	Formally establish STCSG							
Year 0	2024	Submission to SoS of Sandwich Tern CIMP							
Year 0	2024	Approval of Sandwich Tern CIMP							
Year 1	2025	Fabrication							
Year 2	Early spring 2026	Installation							
Year 2	2026 breeding season	Start of compensation Implement annual programme of monitoring and adaptive management including annual review with STCSG							
Year 3	2027 breeding season (and each year thereafter)	Continue compensation and annual programme of monitoring and adaptive management							
Year 3	2027	Start of offshore construction at the wind farm sites							
Year 4	2028	Earliest first power at SEP and DEP							

6.5.9 Consideration of Potential Impacts from Implementation of the Compensation Measure

194. Consideration has been given to any potential impacts that might arise as a result of the implementation of the proposed measures at the Farne Islands. The potential impacts identified are described in **Table 6-7** together with details, where relevant, of how these would be avoided, reduced or mitigated (or maximised in the case of beneficial impacts).
195. For context, Farne Islands SPA is designated for a range of breeding seabird species. These include common tern, Arctic tern, roseate tern, and Sandwich tern (Annex 1 species), common guillemot (regularly migrating species), and a breeding seabird assemblage with those species named plus Atlantic puffin, great cormorant, European shag and black-legged kittiwake.

Table 6-7: Potential Impacts from Implementation of the Measures to Improve Breeding Success at the Farne Islands

Potential impacts	Details	Measures required to avoid, reduce or mitigate
Impacts on other tern species and other bird species that are features of the SPA	Provision of nest box terraces including shelters would be likely to benefit the other tern species that are features of Farne Islands SPA. Improved nesting conditions for terns would be unlikely to have adverse effects on any of the other bird species that are features of Farne Islands SPA.	Place boxes and shelters with reasonable care to avoid any adverse impacts on other species such as puffins.
Impacts on prey availability	Increased numbers of terns would lead to increased consumption of forage fish such as sandeels and sprats close to the colony. However, there is no evidence that increased numbers of terns cause reductions in numbers or breeding success of other seabird species and there is some evidence that increased numbers of terns provide greater defence against nest predators such as crows or large gulls.	N/A
Impacts on populations of large gulls	Herring gulls, lesser black-backed gulls and great black-backed gulls (none of which are named features of Farne Islands SPA) might have marginally reduced opportunities to obtain food from terns if the terns have nest boxes and shelters. However, increases in tern numbers would reduce the need to control large gulls to mitigate their predatory impacts on terns, so the net influence on the populations of large gulls may well be positive through reduced need for gull control, and these large gull populations are not features of this particular SPA.	N/A

Potential impacts	Details	Measures required to avoid, reduce or mitigate
Temporary disturbance in the SPA from installation and maintenance of the nest boxes, shelters and camera system	Installation and maintenance would be carried out before the terns arrive at Farne Islands in spring in order to avoid any disturbance to the terns. All works within the SPA will be carried out with the National Trust alongside the existing management of this SPA and so significant additional impacts from disturbance are not anticipated.	N/A

7 Summary


196. A range of compensatory measures for Sandwich tern from NNC SPA and GW SPA has been considered by the Applicant, with reference to the relevant guidance and informed through a detailed process of pre-application consultation with stakeholders. A package of compensation measures with different delivery models is proposed including:
- Prey enhancement through sandeel stock recovery and sprat stock protection – ecosystem-based management approach (strategic delivery);
 - Nesting habitat improvements and restoration of lost breeding range at Scar Point, Loch Ryan (project-led delivery); and
 - Improved breeding success at SPA sites other than NNC (e.g. Farne Islands SPA or Foulness SPA) (project-led delivery).
197. The inclusion of a package of measures, as advocated by stakeholders, helps to respond to any uncertainties in the delivery or implementation of each of the proposed measures when considered on their own and therefore adds resilience to the overall approach.
198. A further option for a contribution to be made to a Strategic Compensation Fund (such as the Marine Recovery Fund) wholly or partly in place of the Applicant’s proposed measures outlined above or as an adaptive management measure is also proposed.
199. The information provided demonstrates how the proposed measures can be secured and that the mechanism for delivery can be implemented. The Sandwich Tern CIMP will set out the detailed delivery proposals for the agreed compensatory measures based on those set out in this Sandwich Tern Compensation Document and will be produced by the Applicant and approved by the SoS prior to the start of construction.

8 References

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