Outer Dowsing Offshore Wind

Habitats Regulations Assessment

Offshore Artificial Nesting Structures Evidence Base and Roadmap

Document 7.7.4

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Acronyms & Definitions

Abbreviations / Acronyms

Abbreviation / Acronym	Description
AEoI	Adverse Effect on Integrity
ANS	Artificial Nesting Structure
AON	Apparently Occupied Nest
COWSC	Collaboration on Offshore Wind Strategic Compensation
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero, formerly Department of Business, Energy and Industrial Strategy (BEIS), which was previously Department of Energy & Climate Change (DECC)
EPP	Evidence Plan Process
ETG	Expert Technical Group
FFC	Flamborough and Filey Coast
GT R4 Ltd	The Applicant. The special project vehicle created in partnership between Corio Generation (~~a wholly owned Green Investment Group portfolio company~~and its affiliates), Gulf ~~Energy~~ Development and TotalEnergies
GCP	Guillemot Compensation Plan
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Assessment
KCP	Kittiwake Compensation Plan
KSCP	Kittiwake Strategic Compensation Plan
MPA	Marine Protected Area
MRF	Marine Recovery Fund
OWF	Offshore Wind Farm
OWIC	Offshore Wind Industry Council
RCP	Razorbill Compensation Plan
RIAA	Report to Inform Appropriate Assessment
SAC	Special Areas of Conservation
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
TCE	The Crown Estate

Terminology

Term	Definition
The Applicant	GT R4 Ltd. The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf ~~Energy~~ Development (GULF)), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (~~a wholly owned Green Investment Group portfolio company),~~and its affiliates) , TotalEnergies and GULF.

Term	Definition
Array area	The area offshore within which the generating station (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling will be positioned.
Baseline	The status of the environment at the time of assessment without the development in place.
Compensatory Measures	Stage 3 of the Habitats Regulations Assessments (see Derogation) involves the development of compensation measures for any features which the report to inform appropriate assessment was unable to conclude no adverse effect on integrity on.
deemed Marine Licence (dML)	A marine licence set out in a Schedule to the Development Consent Order and deemed to have been granted under Part 4 (marine licensing) of the Marine and Coastal Access Act 2009.
Derogation	Stage 3 of the Habitats Regulations Assessments which is triggered once it is determined that you cannot avoid adversely affecting the integrity of a designated site. Involves assessing if alternative solutions are available to achieve the same goals as the project, if there are imperative reasons of overriding public interest, and if compensatory measures will be required.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP) from the Secretary of State (SoS) for Department for Energy Security and Net Zero (DESNZ).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of an impact with the sensitivity of a receptor, in accordance with defined significance criteria.
Evidence Plan	A voluntary process of stakeholder consultation with appropriate Expert Topic Groups (ETGs) that discusses and, where possible, agrees the detailed approach to the Environmental Impact Assessment (EIA) and information to support Habitats Regulations Assessment (HRA) for those relevant topics included in the process, undertaken during the pre-application period.
Habitats Regulations Assessment (HRA)	A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI) and compensatory measures.
Mitigation	Mitigation measures, or commitments, are commitments made by the Project to reduce and/or eliminate the potential for significant effects to arise as a result of the Project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts in the case of potentially significant effects.
Outer Dowsing Offshore Wind (ODOW)	The Project.
Order Limits	The area subject to the application for development consent, the limits shown on the works plans within which the Project may be carried out.

Term	Definition
Preliminary Environmental Information Report (PEIR)	The PEIR was written in the style of a draft Environmental Statement (ES) and provided information to support and inform the statutory consultation process during the pre-application phase.
The Project	Outer Dowsing Offshore Wind including proposed onshore and offshore infrastructure.
The Planning Inspectorate	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
Wind turbine generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation

1 Introduction

1. The Crown Estate (TCE) Round 4 Plan Level HRA determined that it was not possible to conclude no Adverse Effect on Integrity (AEoI) to the black-legged kittiwake (Rissa tridactyla) (hereafter 'kittiwake') features of the Flamborough and Filey Coast (FFC) Special Protection Area (SPA). The Project was one of three developments which it was identified to contribute towards the conclusion of AEoI, and as such is required to contribute towards kittiwake compensation through The Crown Estate Kittiwake Strategic Compensation Plan (KSCP) (document reference 7.8). The Applicant has also proposed mechanisms within the draft DCO to secure required compensation at Project level, so the Secretary of State can be satisfied that the compensation that they consider necessary will be forthcoming. Given the Applicant's role and involvement in the development of the KSCP (finalised in February 2024) the plan has been submitted as part of the Project's Development Consent Order (DCO) application (document reference 7.8).
2. Following completion of The Project's Report to Inform Appropriate Assessment (RIAA; Document 7.1), the Applicant has been unable to rule out an Adverse Effect on Integrity (AEoI) to the kittiwake features of the FFC SPA due to collision, when considering the Project in combination with other plans or projects. The Applicant has therefore provided a derogation case for the Project and has developed suitable compensation measures which as far as possible are consistent with the KSCP (document reference 7.8) as detailed within the Project's Kittiwake Compensation Plan (KCP; document reference 7.7.1).
3. Within the RIAA, the Applicant has concluded that there would be no AEoI to the common guillemot, *Uria aalge* (hereafter 'guillemot'), and razorbill, *Alca torda* and seabird assemblage features of the FFC SPA or to the guillemot feature of the Farne Islands SPA due to displacement, both when considering the project alone and in-combination with other plans or projects. Natural England have concluded no AEoI for the Project alone but cannot rule out AEoI for guillemot and razorbill in-combination with other plans or projects or for the Flamborough and Filey Coast assemblage feature at the FFC SPA and for guillemot in-combination at the Farne Islands SPA.
4. Following consultation with Natural England through the Evidence Plan Process, the Applicant has provided a 'without prejudice' derogation case for both guillemot and razorbill, in relation to the FFC SPA (and for the assemblage) and for the Farne Islands SPA in relation to guillemot; alongside this, a number of options for Project alone and collaborative compensation measures have been developed as detailed within the Guillemot Compensation Plan (GCP; document reference 7.7.2) and the Razorbill Compensation Plan (RCP; document reference 7.7.3).
5. In the event that the Secretary of State determines potential for AEoI and considers that compensation is required, the Project has provided sufficient confidence that the compensation measures are available, securable and deliverable.
6. This document provides the evidence base and roadmap for the delivery of Artificial Nesting Structures (ANS) for kittiwake, guillemot and razorbill breeding on offshore structures.

7. Section 2 provides information on the methodologies used to determine an evidence base. Section 3 provides the ecological evidence for the use of ANS. Section 4 provides a roadmap for the delivery of this compensation measure, including ANS design recommendations, the suitability of the ANS search locations, the scale of compensation provided and adaptive management and monitoring.
8. Evidence is presented of all three species colonising offshore structures in UK waters. Kittiwakes have been recorded breeding on at least 26 offshore platforms in UK waters and are present across many more. There is a growing evidence base regarding auks breeding on offshore platforms (including proven breeding of both guillemot and razorbill on offshore platforms in the vicinity of the Projects ANS areas) (Orsted, 2021a), and that artificial nesting is therefore a suitable compensation option to increase recruitment into the population through provision of breeding sites with productivity higher than averages at natural colonies. It is therefore proposed that all three species could colonise an offshore structure and should this occur, could benefit from breeding in the offshore environment if environmental conditions are favourable.
9. Discussions regarding the development of this measure were framed around an earlier version of the Defra compensation guidance (published in 2021). However, although still under consultation, updated guidance has been published recently (Defra, 2024). The new proposals prioritise Ecological Effectiveness when considering compensation, i.e. the ecological outcome and the confidence that the measures will be effective.
10. This report should be read alongside the Project's KCP (Document 7.7.1), GCP (document 7.7.2), RCP (document 7.7.3) and the KSCP (document 7.8).
11. The use of ANS forms the primary compensation measure for kittiwake. For guillemot and razorbill, the Applicant maintains that, should compensation be required, the implementation of predator control at the Plémont Seabird Reserve (see Predator Control Evidence Base and Roadmap (document reference 7.7.5)) can deliver the full requirement based on the Applicant's approach; however the additional measures in the south-west (see Additional Measures for Compensation of Guillemot and Razorbill (document reference 7.7.6)) and the ANS are measures which will be pursued were the SoS to require a higher quantum of compensation than that based on the Applicant's approach.
12. Details of the compensation requirements for guillemot and razorbill, calculated using the Applicant's approach and Natural England's anticipated approach, are presented in each of the species specific Compensation Plans: the KCP (document reference 7.7.1), the GCP (document reference 7.7.2) and the RCP (document reference 7.7.3).

13. As stated in paragraph 10, whilst the Applicant maintains that, should compensation be required, the implementation of predator control at the Plémont Seabird Reserve can deliver the full requirement for auks based on the Applicant's approach, should the SoS deem that a high compensation quanta is required, this measure could be augmented by additional measures in south- west England (Additional Measures for Compensation of Guillemot and Razorbill (document reference 7.7.6) and the ANS. Therefore, in the event that an AEoI is identified for either (or both) auk species, a combination of these measures could be used to deliver compensation, dependent on the final quantum deemed necessary by the Secretary of State.

14. In addition, the Applicant has access to the collaborative predator eradication measures being developed for the Isles of Scilly by Defra, DESNZ, Natural England, The Wildlife Trusts, OWIC, The Crown Estate, and RSPB under the library of measures for the Marine Recovery Fund (MRF). Available detail on this measure is provided within document 7.7.6 submitted at Deadline 6 on the 4th April 2025.

15. The Applicant has provided RWE Dogger Bank South with its updated compensation quanta based on Natural England's preferred approach identified in REP5-167. Following discussion with RWE Dogger Bank South regarding Natural England's revised compensation quanta, the Applicant has received the following statement from RWE Dogger Bank South:

'Based on the amount of available habitat suitable for the guillemot and razorbill to 'nest' at the Isles of Scilly as documented by the DBS Projects' colony count and habitat surveys undertaken in July 2024 (https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010125/EN010125-001364-Guillemot%20and%20Razorbill%20Compensation%20Site%20Shortlist%20Refinement%20Report%20Revision%202%20Clean.pdf), it is predicted that an eradication at the Isles of Scilly could provide enough rat free nesting spaces for both ODOW's and the DBS Project's guillemot and razorbill compensation needs, based on the compensation numbers for each species as derived from the HOW4 method using the 95% UCL at a 3:1 ratio.'

16. This document has been updated following a request from Natural England and as agreed by the Applicant with the Examining Authority (ExA) to update the Habitats Regulations Assessment (HRA) related documentation for Deadline 4 to reflect changes made by the Applicant to the Project during the Examination phase.

17. The Applicant has previously provided environmental reports for these updates throughout the Examination as appropriate (through the submission of the Habitats Regulations Assessment for the Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor (PD1-091)), confirming that no changes made altered the previously drawn conclusions within the Report to Inform an Appropriate Assessment (RIAA).

18. This current version of this report provides an update to that submitted within the Application arising from the following project changes:

- The introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the Project array area.

- updates to “Natural England’s” approach for certain assessment values where further information has been provided by that organisation post-Application .

19. Further updates contained herein are focused on:

- Updated compensation quanta as defined by Natural England’s Deadline 5 advice on compensation calculation methods (REP5-167 Appendix G3 - Updated advice on seabird compensation calculations and the Applicant’s response to this, in 24.2 The Applicant's Comments on Deadline 3 Submissions.
- The calculation methodology has been updated to the BTO method throughout the document, although these updates primarily effect Section 4.5. The Applicant met with Natural England on 23rd October 2025. During these discussions, it was agreed that if the Applicant were to commit to using the Upper Confidence Interval (UCI) rather than the central impact estimate to calculate the required compensation, Natural England would be comfortable with a maximum compensation ratio of 2:1. This equates to a maximum of 720 nesting spaces.

2 Methodology

20. A literature review was undertaken to determine the evidence of kittiwake, guillemot and razorbill breeding on offshore structures and establish the potential benefits of creating artificial structures for these species. Literature searches included, but were not limited to, scientific journals, government reports, relevant websites (e.g., RSPB), and grey literature. A large body of evidence has already been compiled by Hornsea Project Four (Ørsted, 2021a; Ørsted, 2021b; Ørsted, 2022) and therefore where possible these reports have been referenced rather than providing duplicated material.
21. Data on the presence of kittiwake, guillemot and razorbill on offshore structures has also been collected in the southern North Sea, in the UK, Norway and The Netherlands. These data were compiled by Ørsted for Hornsea Project Four and are presented in an annex to this report. Additionally, the Applicant has undertaken its own surveys of oil and gas platforms in proximity to the Project array area, the results of which are also presented in Section 5.
22. To determine the ecological feasibility of implementing compensation measures via an ANS for kittiwake, razorbill, and guillemot, literature reviews were undertaken as described above on the species ecology, breeding phenology and demography. This information was used to confirm the suitability of the ANS search locations and provide ANS design recommendations for the nesting requirements of each species.

3 Evidence for the Effectiveness of Offshore Artificial Nesting Structures

3.1 Background

23. Offshore artificial structures offer nesting space to seabirds which may provide a vital buffer against declining coastal populations. In areas where seabird populations are in a favourable and/or increasing condition, offshore structures offer additional nesting space away from areas where competition for resources are already high. Structures can be ideally situated in terms of proximity of key foraging areas, and in areas where birds are likely to recruit into key nearby populations (e.g. those in need of compensation). Furthermore, there is often reduced predation pressure offshore, which in addition to increased prey availability or decreased energetic demands from foraging, can increase the productivity to levels higher than at natural onshore colonies.

3.2 Kittiwake

3.2.1 Introduction

24. UK kittiwake populations have experienced considerable declines over the last 40 years, with an overall decline of 55% since 1985. Recent declines have been most substantial at Scottish, Welsh and Irish Republic colonies, however English colonies have remained relatively stable over the period 2000 – 2021 (Burnell *et al.*, 2023). Despite overall population declines, kittiwakes are continuing to colonise artificial structures. Provision of artificial structures may therefore provide a vital refuge to buffer against declining coastal populations by providing nesting likely to deliver higher than average productivity, to increase recruitment of birds back into the natural nesting UK population. Likewise, birds using artificial structures in English waters may not be under the same pressures driving declines at colonies in other parts of the UK and may therefore be more likely to prosper.

3.2.2 Evidence of Kittiwake Breeding on Artificial Structures

25. There is considerable evidence that kittiwake do not exhibit a preference between natural or artificial nesting sites (Coulson, 2011). The first recording of kittiwakes breeding on artificial structures was in the early 1990s in the Norwegian Sea (Christensen-Dalsgaard *et al.*, 2019) and they have been breeding successfully on offshore platforms in the UK since at least the late 1990's (Unwin, 1999) and possibly earlier (Tasker *et al*., 1986). There are now more than 26 offshore sites with a confirmed breeding kittiwake population in northwest Europe (Christensen-Dalsgaard *et al.*, 2019; Ørsted, 2021a). This includes the kittiwake colony on the Morecambe gas platform that was colonised in 1998 and has been closely monitored (SOC, 2023).

26. Despite the global decline, kittiwakes continue to breed offshore in large numbers. Collating data from just two studies (Christensen-Dalsgaard *et al.*, 2019; Ørsted, 2021a) found over 2000 Apparently Occupied Nests (AONs). With populations of this size nesting offshore, the consequent juvenile dispersal is likely to provide a significant contribution to declining kittiwake populations (Christensen-Dalsgaard *et al.*, 2019).
27. The numbers of kittiwakes nesting on both urban locations and artificial structures appear to be stable or even increasing (JNCC, 2022, Turner, 2010 & 2018). Additionally, a study in Norway on breeding kittiwakes on offshore oil rigs indicated high minimum productivity (number of chicks fledged per nest) rates of 0.61-1.07, exceeding those from both natural populations and coastal man-made structures (Christensen-Dalsgaard *et al.*, 2019). This pattern was repeated in colonies in the southern North Sea, with five out of six colonies having higher productivity on offshore platforms compared with natural east coast colonies (Ørsted, 2021a). This may be explained by the closer proximity of offshore structures to potential foraging sites, alongside greater distance from land-based predators (Daunt *et al.*, 2002; Lewis *et al.*, 2001).

3.2.3 Colonisation Rate

28. Owing to a lack of data on colonisation of artificial structures, predicting the growth rate of a kittiwake colony on a new artificial site is challenging. However, artificial growth patterns appear to follow those seen at natural sites. New colonies are usually formed by 3-20 young birds and show rapid growth, doubling in size each year for the first few (2-4) years (Coulson, 2011). Following these initial years, colony growth slows to a rate of approximately 10-20% per annum (Coulson, 2011; Kidlaw, 2005). Early growth of the colony is highly dependent on successfully attracting immigrants and prospective breeders. The rate of philopatry varies and depends on the size, age and productivity of the natal colony, combined with nest site availability and quality of the site the breeding bird prospects. Since a relatively small proportion of young kittiwake (between 22% and 36% (Coulson and Coulson (2008); Coulson and Neve de Mevergnies (1992)) remain at their natal sites (Coulson and Coulson, 2008), it is likely that strategic placement of an artificial structure would create high potential for the development of a new colony from dispersing individuals.

3.2.4 Estimating the Recruitment Pool of Prospecting Birds

29. The size of the annual pool of prospecting kittiwakes that are potentially available for recruitment to an ANS can be estimated. This provides an indication of ANS colonisation and growth potential. The majority of birds that make up this pool of birds would be from local colonies, with the largest colony being FFC SPA. This can be calculated by considering the local breeding population size within prospecting range of an ANS, dispersal rates, local productivity rates, survival rates to breeding age and accounting for colony population maintenance as a consequence of natural mortality and current colony growth rate. Rates of dispersal of first-time and experienced breeders vary between species and colonies and these factors determine the likelihood or time frame for an ANS to be colonised. Natal dispersal rates range from 64-78% for kittiwake. Using the lowest rate of dispersal, a colony the size of FFC SPA (~~39,653~~44,574 AONs; Clarkson *et al.*, 2022) with a standard rate of productivity (0.819) would produce ~~20,785~~23,364 young per year that could potentially recruit to an ANS within range. This excludes consideration of kittiwakes nesting on offshore structures (see section 3.4), much closer to the sites proposed for the offshore ANS for the Project, which would further increase the pool of available recruits.

3.3 Guillemot and Razorbill

3.3.1 Introduction

30. Guillemot and razorbill have shown similar UK population trends over the last 40 years. The guillemot population has increased over the period 1985 – 2021 by approximately 23%, although this includes decline by 8% over the period 2000 – 2021. Razorbill numbers have also increased, by approximately 45% between 1985 – 2021, with an increase of 18% between 2000 – 2021. Scotland hosts the largest populations of both species within the UK. Declines in Scottish populations of guillemots, and relative stability in Scottish populations of razorbill, suggest that English populations of both species are thriving (Burnell *et al.*, 2023).
31. Both guillemot and razorbill form large breeding colonies on cliffs, typically between March and July but with substantial colony attendance through the winter months as well. During the breeding season, they forage close to the coast and generally feed on small fish and crustaceans. The rest of the year they spend more time at sea. Although there is limited evidence to date regarding the extent to which these species breed on offshore structures there is robust evidence that they do congregate on them in large numbers (for example, see counts of auks presented in Annex D of ES Appendix 12.1).
32. It can be difficult to tell whether guillemot or razorbill are actively incubating an egg because, unlike kittiwake, they do not construct a visible nest. A detailed survey of offshore structures in 2023 included assessment of the behaviour and location of auk species to provide insight as to whether offshore structures may be used as a compensation measure for these species. Recent evidence has also demonstrated that these aggregations do contain breeding birds, with guillemots attending eggs photographed on a southern North Sea platform in 2023 (see Figure 3.1).

3.3.2 Evidence of Guillemot and Razorbill Breeding on Artificial Structures

33. Evidence of guillemot and razorbill breeding on artificial structures is limited in comparison to kittiwakes. However, surveys covering sixteen offshore structures in the southern North Sea found evidence of approximately 100 guillemots and 13 razorbills potentially nesting on one structure (Ørsted, 2021a). Surveys also showed birds resting on lower sections of the structure. Photographic evidence of auk breeding on an offshore structure is provided in Figure 3.1. More recently, the Project commissioned surveys of offshore platforms within a 20km buffer of the array area in 2022 and 2023. During these surveys, both guillemot and razorbill were observed occupying suitable breeding locations on at least one structure. Breeding was not confirmed from the boat based surveys but the presence of many birds occupying the same area suggests breeding is possible (ODOW, 2023). Subsequent correspondence with a platform operator has confirmed that guillemot breeding (with presence of eggs in photographs) was taking place on offshore platforms in 2023 (Figure 3.1). Evidence has also been recorded for razorbill breeding on other surveys undertaken within similar areas of the southern North Sea (Figure 3.2, Ørsted, 2022).
34. Outside of the UK, guillemot and razorbill have been recorded breeding on an artificial structure on the Swedish island of Gotland. The structure consisted of ledges on the outside of a cliffside building with an in-built lab and monitoring system (Hentati-Sundberg *et al.*, 2012). Despite the availability of natural nesting space on the island, approximately 75 pairs of guillemot and 10 pairs of razorbill have been recorded breeding on the structure, supporting the idea that some individuals of both these species will colonise an artificial structure in preference to natural nesting sites (Stockholm Resilience Centre, 2020).

Figure 3.1: Guillemots attending eggs on an offshore installation in the southern North Sea in 2023.

Figure 3.2: A razorbill attending an egg on an offshore installation in the southern North Sea (Ørsted, 2022)

3.3.3 Colonisation Rate

35. Predicting potential growth rates of guillemot and razorbill colonies on artificial sites is challenging owing to a lack of monitoring, with most UK evidence being anecdotal. However, monitoring at the Stockholm Resilience Centre (2020) over 12 years has showed that guillemot numbers on an artificial nesting site rose to 75 pairs, and razorbill numbers to 10 pairs.
36. Across other species, colonisation rates appear to reflect those of natural populations. For example, black guillemots breeding in artificial nests showed a 22-fold increase in the number of breeding pairs over a 16-year period (The Black Guillemots of Cooper Island, 2021).
37. Canna and Sanday were declared rat free in 2008 after an extensive eradication program (Bell *et al.,* 2011). Between 2009 and 2018, guillemot numbers have grown from 685 to 2,850 individuals. Over the same period, razorbill numbers have grown from 430 to 545 individuals. These are increases of 316% and 26%, respectively (SMP database, 2023).
38. A study of the Isle of Canna guillemot colony from 1974 to 1982 showed average annual growth of 10-16% at various sub-colonies from starting populations of approximately 50 to 100 breeding pairs (Swann & Ramsay, 1983). This may be more realistic for an ANS as re-colonisation rates tend to be higher.
39. Early growth of the colony is highly dependent on successfully attracting immigrants and prospective breeders. Philopatry in guillemots is suggested to occur in 42-69% of birds based on the multi-colony study by Harris *et al*. (1996) and a later study by Harris *et al*. (2007), although Swann and Ramsay (1983) reported a high degree of philopatry (79%) in an expanding population. In razorbill philopatry rates are suggested to be even higher occurring in 91.2% of birds. This rate of philopatry is based on studies undertaken by Lloyd and Perrins (1977) and Lavers *et al*. (2007).
40. The benefits to kittiwakes using ANS, such as increased productivity and proximity to feeding grounds, are also relevant to guillemot and razorbill; these structures may potentially support growth at a higher rate than seen at existing natural colonies.

3.3.4 Estimating the Recruitment Pool of Prospecting Birds

41. The potential for an ANS to recruit breeders from other colonies depends on the size of the reservoir of birds prospecting for sites within the population. The number of birds that make up this pool of birds is dependent on the breeding success of the local colonies, in this case the largest colony being FFC SPA. This can be calculated by considering the local breeding population size within prospecting range of an ANS, dispersal rates, local productivity rates, survival rates to breeding age and accounting for local colony population maintenance as a consequence of natural mortality and current colony growth rate. Rates of dispersal of first-time and experienced breeders vary between species and colonies and these factors determine the likelihood or time frame of an ANS to be colonised. Natal dispersal rates range from 21-58% for guillemot (Swann and Ramsey 1983, Horswill and Robinson 2015) and 8.8-17% for razorbill (Lavers *et al*., 2007, Horswill and Robinson 2015). For guillemot, using the lowest rate of dispersal, a colony the size of FFC SPA (~~105,832~~111,925 individuals multiplied by 0.667 to infer a number of breeding pairs of ~~70,589~~74,654; Clarkson *et al.*, 2022) with a locally derived rate of productivity (0.61) (Butcher *et al*., 2023) would produce 9,~~042~~606 young per year that could potentially recruit to an ANS within range. For razorbill using the lowest rate of dispersal, a colony the size of FFC SPA (~~44,701~~45,780 individuals multiplied by 0.667 to infer a number of breeding pairs of ~~29,815~~30,535; Clarkson *et al.*, 2022) with a locally derived rate of productivity (0.51) (Butcher *et al*., 2023) would produce 1,~~338~~377 young per year that could potentially recruit to an ANS within range. As these calculations employ the lowest dispersal rates given for each species, they are considered to be precautionary.

3.4 Summary of the offshore structure breeding bird census

3.4.1 Background

42. In order to better understand the extent and distribution of 'offshore breeders' close to the array area, the Project commissioned a survey of breeding birds on oil and gas platforms within a 20km radius of the array area between 28 July and 1 August 2022 (16 platforms) and a repeat survey between 12 June and 15 June 2023 (17 platforms). During this survey, counts of kittiwake AONs, and data on presence (and absence) of guillemot and razorbill on offshore structures were collected. An additional platform was included in the 2023 survey which had been excluded from 2022 due to ongoing maintenance at that structure (ODOW, 2023).

3.4.2 Methods

43. There were 17 offshore structures identified within a 20km buffer of the Project array, detailed within the report (Table 5.1). Boat-based ornithological surveys were undertaken by two experienced ornithologists in accordance with the Ornithological Monitoring Plan (RSK Biocensus, 2022) and following methodology described in the JNCC advice note which sets out 19 principles for surveying (Thompson, 2021). In 2022, it was not possible to get proximity agreements in place with the platform operators and therefore the surveys were all taken from outside the 500m safety zone. As such the counts for 2022 should be considered minima as the undersides of the structures were generally not visible. In 2023, proximity agreements had been reached with many of the platform operators and the census could be undertaken from a closer distance (ranging from 200m to 500m depending on the platform).
44. Photographs were taken of areas that appeared to have nesting kittiwakes, sketches of the structures were made, and the number of nests, trace nests, and loafing birds were recorded. The number of birds recorded nesting on the structures is likely to be an underestimate because the distance of the survey vessel from the platforms preclude counting any nests that were underneath the platform superstructure. Similarly, the height afforded by the observation platform will have precluded observation of auk eggs or young on any parts of the platform that were higher than the observers and may have led to poorer detection of kittiwake nests at height. As such, the numbers recorded on both surveys should be considered underestimates.

3.4.3 Results

3.4.3.1 Kittiwake

45. Of the platforms surveyed, six platforms were recorded as hosting nests in each year, with five of those being occupied in both years (repeat usage). In 2022, a minimum of 253 AONs were recorded. In 2023, this number had increased to 836. The large discrepancy here may be due to:
    - A count at one platform with large numbers of nests in 2023 which had not been recorded in 2022. The platform that held most birds in 2023 was not surveyed in 2022 due to ongoing maintenance at that site in 2022;
    - All surveys in 2022 were undertaken from at least 500m away from the platforms, whereas the 2023 surveys were able to be undertaken up to 200m from the platforms.
46. Counts of kittiwakes during both years of survey are presented in Table 3-1.

Table 3-1: Numbers of Kittiwake associated with offshore platforms from 2022 and 2023

Platform number	Occupied nests (AONs) 2022	Occupied nests (AONs) 2023	Trace nests 2023	Other individuals present 2023	Difference in AONs between 2022 & 2023 (noting differences in coverage)
1	0	0	0	8	0
2	0	0	0	8	0
3	0	0	0	11	0
4	52	40	16	17	-12
5	65	36	37	11	-29
6	20	0	0	0	-20
7	32	69	0	17	+37
8	0	0	0	1	0
9	0	0	0	0	0
10	0	0	0	2	0
11	0	0	0	6	0
12	67	273	18	324	+206
13	N/A (not surveyed)	402	27	283	+402
14	0	0	0	28	0
15	17	16	1	31	-1
16	0	0	0	11	0
17	0	0	0	3	0
Totals	**253**	**836**	**120**	**760**	**+583 in 2023**

47. Visual observations confirmed that the nests were predominantly located on the I-beams and were comprised primarily of seaweed. The data have not been analysed to determine whether birds favoured certain nesting locations, however, no immediate trends were apparent.
48. Data across both years of census demonstrate that use of individual platforms varied, potentially due to the presence or absence of particular activities (such as maintenance or construction works in the vicinity of the breeding birds), at a platform scale as well as through differences in detectability and coverage. However, as both surveys were limited in geographical scope to a 20km buffer around the proposed array area, the populations within the wider area were not monitored. Therefore, interannual fluctuations within the survey area may not necessarily mean that the wider offshore population is unstable, and may be more reflective of platform activity, as colony size correlates with platform age suggesting some stability, particularly with older or larger colonies (Christensen-Dalsgaard *et al*., 2020, SOC, 2023)
49. As such, while the data from the two offshore censuses are extremely valuable, connectivity with the proposed array area should be considered within the context of the wider offshore population.

3.4.3.2 Guillemot and Razorbill

50. In 2023, totals of 458 guillemot and 13 razorbill were noted on offshore structures. All records of razorbill, and apart from one bird, all records of guillemot came from two offshore structures. No breeding was confirmed during surveys, due to the height of the observation platform and the fact that neither species build nests that would be visible at range, such as those of a kittiwake, although behaviours consistent with breeding (such as occupying ledges and facing inward towards the platform) were observed. As noted above, subsequent correspondence with a platform operator has demonstrated that guillemot breeding (with presence of eggs in photographs) was taking place on offshore platforms in 2023 (Figure 3.1), further supporting suggestions that at least some of these guillemot were breeding. Other evidence is already available that razorbill can also breed offshore (Figure 2; Ørsted, 2022).

4 Roadmap for delivery

4.1 Consultation

51. The Applicant has undertaken extensive consultation on the compensation measures for the Project, through the Expert Topic Groups (ETGs) under the Evidence Plan Process (EPP). If granted consent, it is likely that the Project will be required to establish a steering group to assist on the implementation, reporting and any other relevant matters, for each species for which compensation is required. The steering group(s) will also aim to engage with relevant stakeholders throughout the process.
52. Extensive consultation with stakeholders will be undertaken before and during construction to ensure cooperation across all monitoring aspects of the artificial nesting structure. Results of monitoring processes will also be discussed. The Outline Kittiwake Compensation Implementation and Monitoring Plan (KCIMP) (document reference 7.7.1.1), Outline Guillemot Compensation Implementation and Monitoring Plan (GCIMP) (document reference 7.7.2.1) and Outline Razorbill Compensation Implementation and Monitoring Plan (RCIMP) (document reference 7.7.3.1) identify the information which will be contained in the final delivery plans.
53. The Applicant has also consulted with Natural England, the Joint Nature Conservation Committee (JNCC), Department for Environment, Food and Rural Affairs (Defra), and The Crown Estate through the development of the KSCP (see document 7.8).

4.2 Design considerations

54. A design and engineering assessment will be undertaken by the Applicant following identification of a suitable site. Discussions with relevant parties (e.g. ornithology experts and engineering professionals) will be required for the structure design. Considerable work has already been undertaken by Hornsea Four in their design of artificial nesting structures for kittiwake and gannet (Ørsted, 2021b) and by Hornsea Project Three (LDA design, 2021). Consequently, much of this work may be built on in terms of design for kittiwake, however additional discussion will be needed to ensure adequate design features for guillemot and razorbill if compensation for these species is required.
55. To ensure successful colonisation of target species, species-specific nesting criteria that represent natural nest requirements will be factored into the structure. Kittiwake, guillemot and razorbill have different nesting requirements, therefore if multiple species are taken forward these could be incorporated into different sections of one platform. Evidence from offshore oil and gas platforms has shown auks and kittiwake breeding on different areas of the same structure as outlined in the Offshore Platform Census Survey Summary Report (section 3.4). Direct evidence of guillemots breeding on an offshore platform has also been provided to the Project (Figure 3.1) and evidence of razorbill breeding on similar structures also exists (Figure 3.2 Ørsted, 2022).

56. In a scenario where the ANS will be used to generate compensation for more than one species, the elements designed for each species will be scalable. As such, should a level of compensation required for a given species be lower than the current assumed precautionary estimates, space allocated to that species could be reduced with that space then allocated to the other species for which the ANS has been designed.

4.2.1 Kittiwake

57. There are several examples of purpose-built off- and onshore artificial nesting structures for kittiwakes with reportedly mixed success at attracting nesting birds. Generally, however, of the artificial nesting structures which hold kittiwake colonies, no particular design is favoured more than another in terms of attracting nesting birds (Ørsted, 2020a). Ecological criteria considered essential for successful ANS design (LDA design, 2021, which the KSCP has agreed to use) are as follows:

- High and steep sided structure with a near vertical back wall and narrow horizontal ledges;
- Adequate ledge dimensions: Horizontal ledges 200mm width, length per pair from 300mm width (working length 400mm);
- Height between ledges at a minimum of 400mm and a maximum of 600mm;
- Lowest ledges located above the reach of wave action at highest astronomical tide;
- Minimum height should account for expected sea level rises and be above splash zone of highest astronomical tide for 2050;
- South facing aspects should be avoided where possible;
- The ANS should be as inaccessible to avian predators as possible, potentially including use of anti-predation features; and
- Capacity to deploy decoys to attract breeders, which can then be removed once the colony is established.

58. Further design details to optimise success are:

- An overhang or roof to protect against weather conditions and an additional predator deterrent. Roof pitch in excess of 25 degrees can be used to deter nesting (of avian predators such as large gulls);
- The ledge overhangs sufficiently to minimise lower ledge fouling, and potential for reducing avian predation; and
- Partitions should be provided between each discreet nesting site.

4.2.2 Guillemot and Razorbill

59. Both guillemot and razorbill may nest in similar locations, including narrow ledges, rock platforms and amongst boulders (Plumb, 1965; Hipfner and Dussereault, 2001; Harris *et al.*, 1996). Available evidence on guillemot breeding habitat requirements suggests a strong preference for near horizontal ledges, typically on natural sea cliffs, but the use of artificial structures has also been documented (Ørsted, 2021; Hentati-Sundberg *et al*., 2011). Guillemots are highly gregarious breeders and as birds seem to gather on broader ledges these sites are more often selected (Olsthoorn & Nelson, 1990). Photos of guillemots on offshore oil platforms, presented in Ørsted (2021) and ODOW (2023) show guillemots gathering on the broader metal ledges around support columns and kittiwakes on the narrow ledges. Although the birds in these photos are not confirmed to be breeding (Ørsted, 2021; ODOW, 2023), they do highlight guillemots' tendency to select the broader ledges at artificial site as is the case on natural cliffs.
60. Purpose-built guillemot ledges could be designed at a maximum depth of 30cm for example. However, any broader ledges may increase the chances of large gulls predating guillemot eggs/chicks (Birkhead, 1977). Moreover, guillemots prefer open ledges as they breed in dense gatherings of up to 20 birds per square metre (Mitchel *et al*., 2004) and do not typically select sites with overhanging ceilings and side walls. This figure reflects how guillemots nest tightly side-by-side along narrow ledges. Further to the design, guillemot nesting ledges should be a single long ledge with no partitioning so that the density of breeding birds can be similar to that which occurs in natural settings.
61. Although highly territorial when defending their breeding site, it appears guillemot breeding success is correlated with the presence of nearby neighbours (Olsthoorn & Nelson, 1990). At natural sites there is tendency for razorbills to select enclosed nesting sites. Olsthoorn & Nelson (1990) report that at the Bullers of Buchan, 46% of razorbill nest sites had either 2 or 3 walls within a bird's length compared to only 15% for guillemots. Considering this is a purpose-built artificial nesting structure, razorbill units could be designed as enclosed cavities scattered throughout the nesting structure. With a cavity unit, the ledge could be designed to slope slightly towards the back (approximately 5°) as razorbills do not build a nest. At natural sites, razorbills occasionally select sites with rugged floors, or which are covered in debris, as this can help stabilise the egg, and locations towards the periphery of a colony compared to guillemots (Hipfner *et al.*, 2001).
62. If there is a requirement to provide breeding habitat for razorbills, enclosed spaces with gravel provided at the edge of an array of ledges should be considered. Although both species will nest in a single line on very narrow ledges, where wider ledges are available, guillemot in particular will nest across, as well as along, the ledge. As such, deeper ledges will have the capacity to support larger numbers of breeding birds.
63. The species specific ANS design requirements are presented in Table 4-1.

Table 4-1: Species specific ANS design requirements.

Design Parameter	Kittiwake	Guillemot	Razorbill
Provision of nesting material	Mud, vegetation, fibrous material	N/A	N/A
Nest unit designed to prevent eggs rolling away	Yes – textured sandpaper like floor to anchor nest to the unit.	Not necessary	Not necessary
Minimum height of nesting unit above sea level[1]	5m	5m	5m
Maximum nesting height above sea level	50m	15m	20-35m
Nesting unit width [No. of pairs able to occupy one unit]	20-40cm [max. 2]	1m (min) [6][5]	30-40cm [1]
Nesting unit depth	20cm	30cm	20-30cm
Nesting unit height	40cm	40cm	40cm
Back wall angle[2]	Vertical	Vertical or angled forward	Vertical or angled forward
Nesting unit walls[3]	Mixture of one or both sides	None or at one end	Required on all aspects
Preference for overhang/roof	No	Yes	Yes
Nesting surface	Course Texture/Flat	Rugged /Flat	Rugged/Flat with ledge lip if not enclosed
Preferred facing direction	Preference away from south/south-westerly aspects		No preference if nest site enclosed
Decoy models[4]	yes	yes	yes

[1]To be adjusted to account for wave height and seasonal swells, [2]back walls with a forward angle to create overhang or create a more enclosed site, [3]side walls to be less deep than ledges so neighbours are visible, [4]decoy model kittiwakes can be placed with used nests to provide both visual and olfactory attractants to the ANS. [5]guillemots calculated based on a density of 20 pairs per 1m^2.

4.3 Site selection

64. The Applicant has undertaken a detailed site selection process to identify offshore locations, in UK waters, where an artificial structure, which provides additional breeding opportunities to kittiwake, guillemot and razorbill, can be established. The site selection process has identified two regions to the north-west and south-east of the Project array area which are ecologically beneficial and technically optimal for the establishment of an ANS. These two areas have been included within the Project's Order Limits and assessed within the Project's Environmental Statement and RIAA, with the intention that construction of up to two ANS within these areas would be therefore consented under the DCO. These two locations are also included within the KSCP, among a wider suite of sites that are not considered here and would be subject to a separate marine licencing process (The Crown Estate, 2024), were these other areas considered preferrable.
65. Sites were selected based on their proximity to existing breeding colonies (so that ANS could be sited in areas where breeding birds would be unlikely to encounter significant competition from other breeding birds), proximity to OWFs (in order to avoid creating a colony at high risk from collisions and/or the impacts of displacement or barrier effects), overlap with areas with high densities of core forage fish such as sandeels and within prospecting range of the recruitment pool of first-time breeders and dispersing adult breeders.

4.3.1 Selection Criteria

66. Considerable site selection work was undertaken and presented by Hornsea Four (Ørsted, 2022). This work culminated in the selection of an optimal area of search for a new structure to accommodate breeding kittiwakes (see Figure 4.1). The site selection methodology presented here builds on this work, using similar agreed criteria, and presents options separate to those proposed by Hornsea Four.

4.3.1.1 Overlap with existing colonies

67. Site selection has only considered sites in English North Sea waters where nesting space availability is likely to be limiting population growth. Sites along the Scottish coast have not been considered due to the greater availability of natural nesting habitat.
68. A limited number of SPAs are available in English waters for kittiwake, and consequently on the east coast, with almost all impacts from OWFs apportioned back to the Flamborough and Filey Coast SPA. Compensation measures will aim to deliver breeding birds back to this site, although where this is not possible, the aim will be to deliver birds back into the bio-geographic population.
69. In the UK, tracking data are available from many seabird colonies which, with predictive modelling techniques, have been used to map the key foraging areas for kittiwakes in UK waters (Cleasby *et al*., 2020; Wakefield *et al*., 2017). These distributions have been informed by tracking data and distance from kittiwake colonies on the east coast mainland.

70. To date, evidence suggests that kittiwake colonies on offshore platforms occur in the area south of the Flamborough front (Pingree and Griffiths, 1978; Ørsted, 2021a; ODOW, 2023). There is a lack of knowledge surrounding where these birds forage and if these areas are shared with onshore nesting birds. This region is outside the core foraging range from FFC SPA but is known to support birds from FFC SPA (Cleasby *et al.*, 2020). Kittiwakes can display high foraging site fidelity (Irons, 1998, Harris *et al.*, 2020), and there is some evidence that kittiwake avoid foraging in areas that are populated with a higher number of birds from a neighbouring colony (Wakefield *et al.*, 2017). Therefore, when determining the location for an artificial nesting structure it is important to choose an area that will avoid competition for resources (in so far as possible) with birds from FFC SPA and other SPAs, as this could result in a reduced breeding success of kittiwakes at the SPAs.
71. The areas proposed for kittiwake are also beneficial for guillemot and razorbill. They are far enough from the existing large FFC SPA colony to suggest that during the breeding season, when most breeding birds are highly constrained and therefore forage relatively close inshore, there will be minimal competition between birds from the FFC SPA colony and birds using the offshore ANS.
72. Site selection for an artificial structure has considered competition for resources alongside proximity to a source location. Based on the studies presented above (Cleasby *et al.*, 2020; Irons, 1998; Harris *et al.*, 2020; Wakefield *et al.*, 2017), a distance of approximately 10km from a large kittiwake colony is the optimal scenario for promoting quick recruitment and population growth. However, this proximity may also result in the artificial colony and natural source colony directly competing for the same food resources and drawing individuals away from SPA colonies. Site selection should therefore find a compromise between these two distances. In this analysis the area between the core foraging zone (mean foraging range) and the mean-maximum foraging range was considered an appropriate compromise to promote colonisation while reducing competition for resources. Kittiwake recruitment would not be compromised with this strategy as approximately 80% of kittiwakes breed within 100 km and 95% within 800 km from their natal colony (Coulson and Neve de Mevergnies, 1992). The majority of guillemots disperse within 280km of their natal colony (Halley and Harris, 1993; Lyngs, 1993; Kampp and Falk, 1998) and razorbills disperse generally within 200km, with a mean distance of 113km (Llyod and Perrins, 1977).
73. Statutory stakeholders have agreed that site selection should avoid the core foraging range distance from FFC SPA (54.7km for kittiwakes, 33.1km for guillemot and 61.3km for razorbill), whist maintaining some connectivity with FFC SPA to allow colony interchange to be a possibility (Mean-maximum foraging range = 156.1km) (Ørsted, 2021c). The search area for a breeding colony should therefore be located beyond approximately 55km and broadly within 150km from the FFC SPA. Where possible, the locations of existing offshore colonies has also been considered as their locations highlight regions proximal to suitable habitat where kittiwakes are successfully breeding. Other information has also been considered such as, information on prey distribution, presence of designated sites, existing infrastructure and planned, under construction and operational windfarm locations.

4.3.1.2 Avoiding protected sites and infrastructure

74. When considering locations for ANS, there are constraints from existing infrastructure and protected sites in the southern North Sea, including oil and gas platforms, marine traffic, cables and pipelines, aggregates and dredging areas, OWFs, protected wrecks, marine conservation zones (MCZs), special areas of conservation (SACs) and SPAs. Ideally, an offshore nesting structure should avoid all of these areas.
75. Given the density of OWFs in the southern North Sea any birds breeding on an offshore structure could be impacted by windfarms. However, where possible an artificial nesting structure should be located far enough away from OWFs to avoid unnecessary collisions of breeding birds with turbines. Initially, areas outside a 15km buffer around all operational and planned OWFs in the southern North Sea region were considered. Oil and gas platforms, pipelines, aggregates and dredging areas, and shipping safety buffers were also mapped and removed from consideration. Through the KSCP Steering Group, the Applicant has undertaken continued consultation with The Crown Estate (including the relevant proximity checks) and relevant stakeholders to ensure commercial criteria used for site selection are appropriate and robust and that the sites would be available subject to the appropriate Agreement for Lease process with TCE. This is further detailed in the KSCP (document reference 7.8).

4.3.1.3 Ecological criteria (prey availability)

76. Ecological criteria have also been considered, with prey availability being a key factor determining the likelihood of colonisation. Key prey species for kittiwake, guillemot and razorbill include small fish, especially sandeel in the northern North Sea, alongside sprats, clupeids and juvenile whiting (Chivers *et al.*, 2012; Bull *et al.*, 2004; Furness and Tasker, 2000; Markones *et al.*, 2009). Studies from the FFC SPA have shown kittiwake in the region predominantly feed chicks on sandeels, Ammodytidae sp, and clupeids such as sprat, *Sprattus sprattus*, guillemots feed chicks on sprat and razorbill feed chicks on sandeels (Butcher *et al*., 2023).
77. Kittiwake distribution at sea during the breeding season is largely driven by factors which influence prey availability (Cox *et al.*, 2013), within the constraints of foraging range from colony for breeding adults. In general, shorter foraging distances are linked to higher breeding success (e.g. Daunt *et al.*, 2002, Lewis *et al.*, 2001). Therefore, an offshore breeding site may enable birds to breed closer to foraging sites, reducing energetic costs associated with finding food, which is likely to result in increased productivity. The primary factors used to identify favourable kittiwake foraging habitat are tracking data and sandeel distribution.
78. Additionally, oceanographic features can be a reliable predictor of prey availability. Kittiwakes can only access prey in the top metre of the water column and so they are often associated with hydrographic features such as shelf breaks and tidal fronts which concentrate prey near the water surface (Leopold, 1993; Skov and Durinck, 1998; Markones, 2007). Areas where the water column is well-stratified with the movement of tidal currents over uneven topography are thought to be important in creating surface aggregations of sandeels that kittiwakes exploit (Embling *et al.*, 2012).

79. Guillemot distribution has been linked to densities of sandeels; a key prey item for this species. Although low densities of sandeels do not necessarily predict low densities of guillemot, high sandeel density in the breeding season does correlate with high guillemot density (Wright, 1997). Siting ANS in areas with high breeding season densities of sandeel may encourage utilisation from guillemots.
80. As guillemot and razorbill can forage deeper in the water column, as well as close to the surface, they are less sensitive than kittiwake to factors driving food availability at the surface.

4.3.1.4 Location determination

81. A selection process was undertaken by ruling out or favouring locations based on the seven criteria outlined in Table 4-2. The area of search for a suitable location for an artificial nesting structure is the southern North Sea up to the Scottish border and out to the limits of the UK EEZ. The same criteria were used for each of the three species under consideration. This work highlighted broad areas of search for offshore artificial nesting structures across the southern North Sea.
82. The optimum location for an artificial nesting structure will be outside of the core foraging areas of kittiwake from FFC SPA to avoid competition for resources but it should have some connectivity to maximise the probability that the structure will be colonised over time. Therefore, the area between the mean foraging range and mean-maximum foraging ranges of kittiwake from FFC, Farne Islands or Coquet Island SPAs was considered appropriate as an area of search. The same process was also followed for guillemot and razorbill from the relevant SPAs to determine their connectivity with a potential structure.

Table 4-2: Key considerations when defining optimal locations for ANS

Category	Criteria	Description
Overlap with existing colonies	Minimise competition for resources with birds from existing colonies	Outside mean (core) foraging ranges from SPAs. Avoid overlap of artificial nesting structures foraging area with that of existing North Sea colonies
	Colonisation potential	Proximity to existing colonies – Inside mean maximum foraging range of a SPA
Avoiding protected sites and infrastructure	Outside of designated sites	Artificial nesting structure should be situated outside of the southern North Sea SAC, SPAs and MCZs.
	Away from offshore wind developments	>15km from existing and planned windfarms.
	Away from infrastructure	Outside of known oil and gas platforms, cables and pipelines, aggregates and dredging areas, protected wrecks, and shipping safety buffers.
Prey availability	Sandeel distribution	Proximity to sandeel grounds based on the distribution provided by Jensen *et al.*, 2011.
	Foraging areas	Overlap with core foraging areas for kittiwake, as identified from tracking data using percentage at-sea utilization distribution from Cleasby *et al.* (2020).

83. As demonstrated in Figure 4.1, there are large portions of the southern North Sea that meet the ecological site-selection criteria, however from north Norfolk to roughly the location of the Hornsea Projects, locations are more constrained, primarily due to existing infrastructure. Within this area there are relatively few suitable areas to place a structure.
84. More availability exists to the north, however sites are not as close to the core foraging habitat of kittiwake and are further away from the Project which could make the construction and maintenance of a structure more challenging or costly.

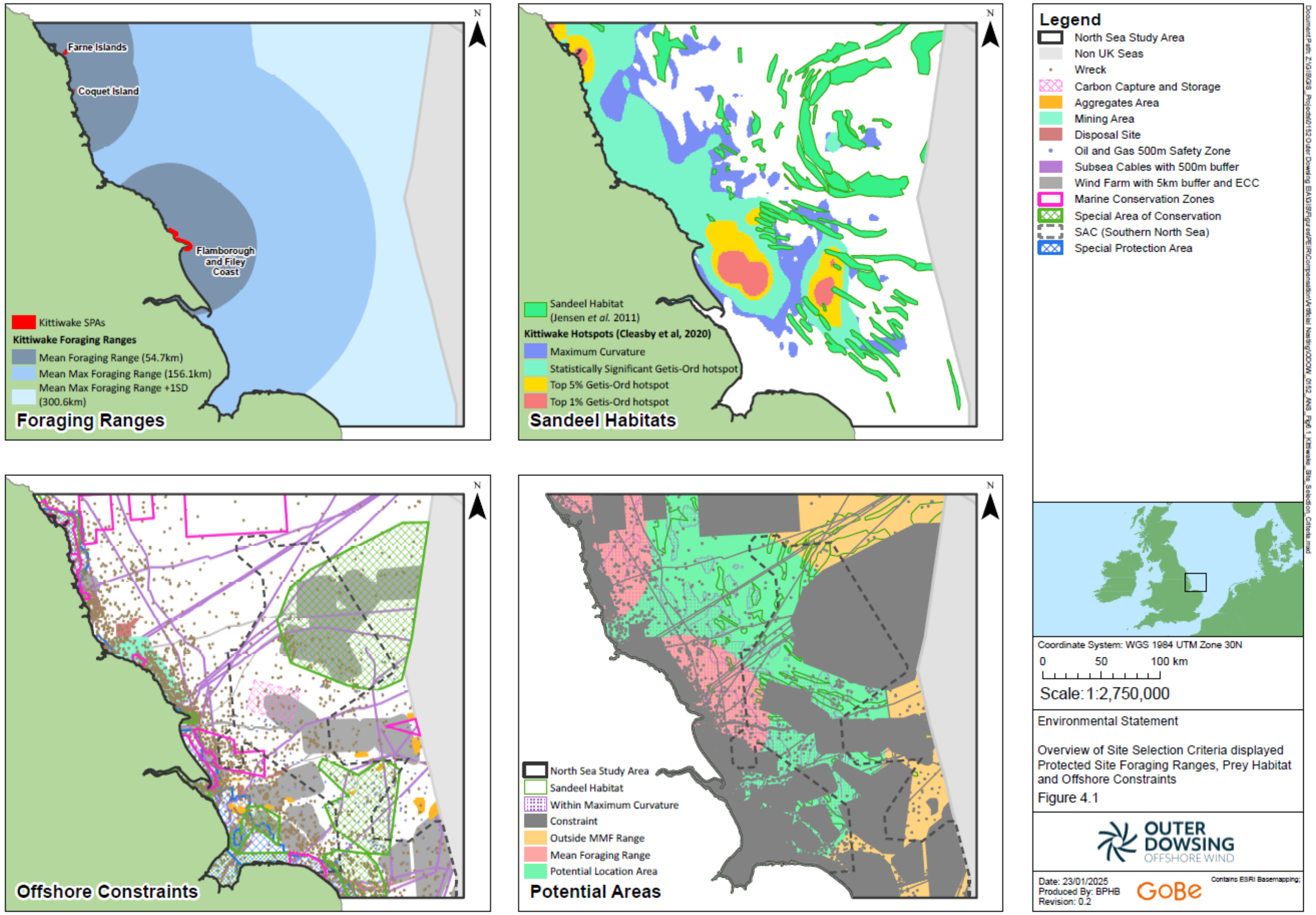

Figure 4.1: Maps showing spatial extent of key criteria considered when defining most suitable locations for ANS

4.3.1.5 Engineering considerations

85. Following identification of the preferred ecological areas for the provision of an artificial nesting structure, a number of engineering parameters were considered to facilitate a technically advantageous design for the platform, namely:

- Bathymetry between 15 – 30m;
- Presence of hard substrate at the surface; and
- Quaternary sediment thickness (>20m).

86. Data on these three constraints were collated from open-source datasets (British Geological Survey and EMODnet) and overlain on the heatmaps. For both the hard substrate and quaternary sediment thickness criteria, the resolution of the available data was insufficient to use for site selection and as such, both were removed from the constraints analysis at this stage.
87. Following the application of the bathymetric constraint to the ecologically favourable areas, the number of preferred areas was reduced to five discrete locations south of Dogger Bank. Of these five areas, it was considered that there was no specific determinants between each site, and consequently, it was decided to progress with the two areas closest to the Project, one to north-west and one to south-east of the array area, as these would provide the most economic solutions. These areas are illustrated in Figure 4.2
88. As noted in Section 4.3 these two areas are also included in the KSCP.
89. One of these areas is adjacent to and partially overlaps with the area identified by Hornsea Four. Following refinement of the area under consideration, most of the Hornsea Four area has been removed from the ANS areas, due to bathymetry site selection criteria. The final ANS areas also exclude the final AfL for the Hornsea Four ANS.

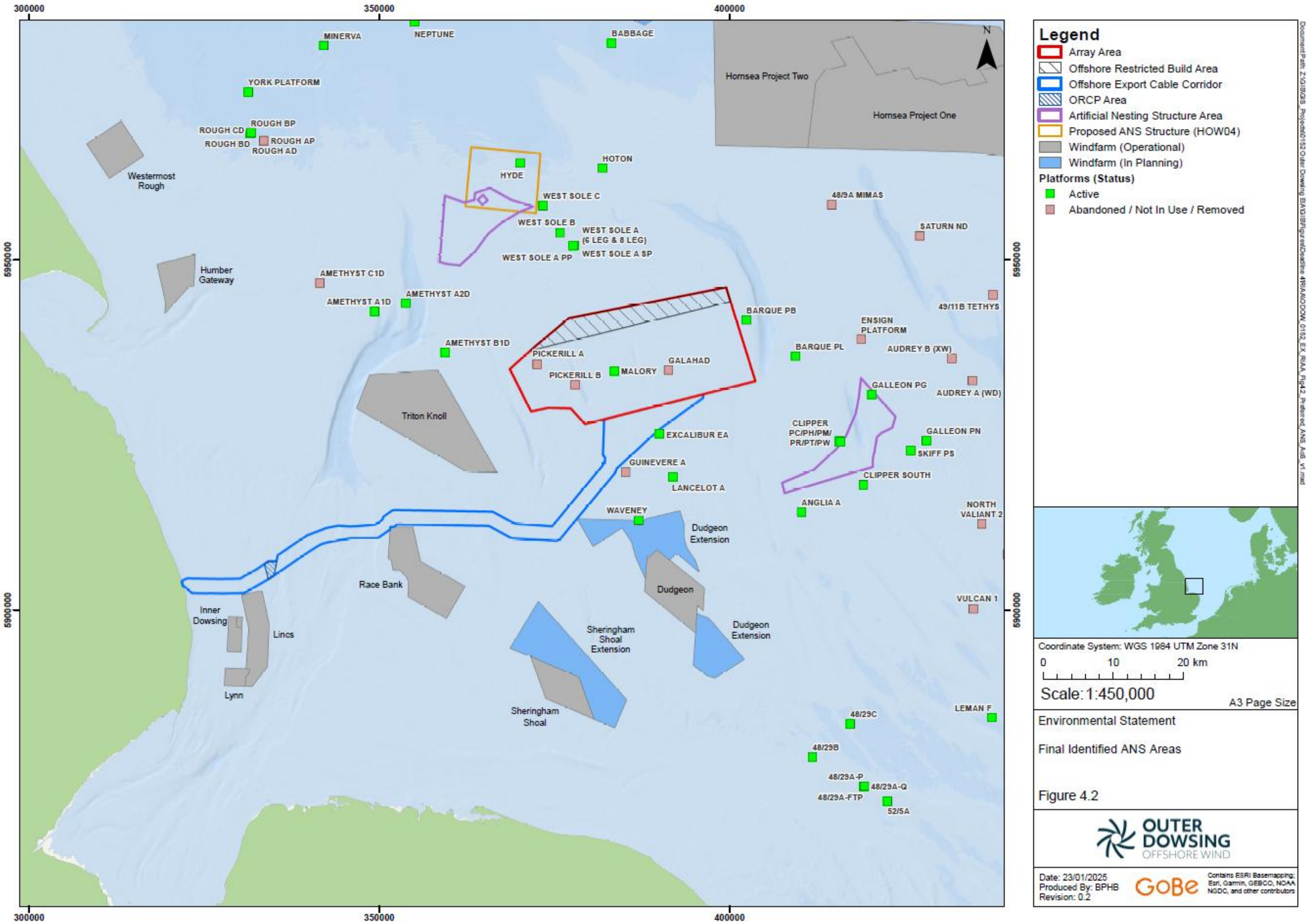

Figure 4.2: Map showing the ANS areas to the north-west and south-east of the array area (coloured purple).

4.3.1.6 Key consents and legal requirements

90. The Applicant has included consent to develop, build and maintain any artificial nesting structure within the draft Development Consent Order (DCO) and associated deemed Marine Licences (dMLs) for the wider Project. As such, all impacts predicted to arise from the works have been fully assessed within the Environmental Statement, Report to Inform Appropriate Assessment and the associated documentation that accompanies the DCO application. Through the KSCP Steering Group, the Applicant has undertaken consultation with The Crown Estate (including the relevant proximity checks) and relevant stakeholders to ensure commercial criteria used for site selection are appropriate and robust and that the sites would be available subject to the appropriate Agreement for Lease process with TCE. This is further detailed in section 11.2 of the KSCP.

4.4 Monitoring, adaptive management, and reporting

91. Options for monitoring, subsequent adaptive management (should it be required) and reporting will be developed once the designs and locations for ANS are finalised. The details will be presented in the Kittiwake Compensation Implementation and Monitoring Plan (KCIMP) that will be developed post-consent and within the Guillemot CIMP and Razorbill CIMP if this measure is required for these species.
92. Options for adaptive management may include modifications to the nesting sites to make them more attractive for the target species, increasing the overhang of the roof to increase shelter and/or protection from predation or supplementary feeding. Options for adaptive management will be kept under review and discussed with the members of the relevant species-specific Compensation Steering Group prior to, and throughout the lifetime of the Project, with discussions informed by the results of any agreed monitoring.
93. For the purposes of the delivery of strategic compensation, monitoring and adaptive management are covered under sections 12 and 13 of the KSCP (document 7.8). A similar mechanism to that proposed by the Project for the agreement and final details for monitoring, adaptive management has been proposed within the KSCP, through the development of a Kittiwake Strategic Implementation and Monitoring Plan (KSIMP) which would be agreed with the steering group. An outline example of this document is provided as Annex 1 (document reference 7.8.1) of the KSCP.

4.5 Scale of Compensation

4.5.1 Kittiwake

94. The predicted impact from the Project, for which compensation will be required to be delivered is 15.5 birds, based on the Applicant's approach (as detailed within the RIAA (document 7.1)). This number is based on the summed mean peak bio-seasonal occurrence. The proportion of adults within the population is defined using adult proportions from the site--specific Digital Aerial Survey (DAS) data, with birds apportioned to the FFC SPA using the NatureScot apportioning method and including offshore breeding birds (document reference 7.1.1), as agreed by Natural England. ~~The compensation requirement calculated with both the Applicant's and Natural England's preferred approaches are presented in Table .~~ The UCI impact is 41.0 birds. Compensation quanta have been calculated using the BTO's bespoke 'staggered entry' approach, as recommended by Natural England. This method is considered to be more comprehensive with regard to the measure delivering an appropriate level of compensation. As noted in paragraph 19, during the meeting held on the 23rd October 2025, it was agreed that if the Applicant were to commit to using the Upper Confidence Interval (UCI) rather than the central impact estimate to calculate the required compensation, Natural England would be comfortable with a maximum compensation ratio of 2:1. This equates to a maximum of 720 nesting spaces.

~~95. The presentation of the Applicant and Natural England's preferred methods are aligned with those presented in the KSCP (document reference 7.8). Further information on these methods is provided in section 8.2 of the KSCP. Note that the values presented in the KSCP are the range of quantum based on the methods and ratios presented below, but under the combined scenario from the Project and RWE's Dogger Bank South West (DBSW) and Dogger Bank South East (DBSE) projects, as at the time of the KSCP finalisation (February 2024). These numbers presented for the Project within the KSCP are higher than those presented here, due to the application of site specific adult proportions, and not having accounted for apportioning of impacts to the offshore colonies, as has subsequently been agreed with Natural England.~~

95. Therefore, quanta of compensation ratios up to a maximum of 2:1 have been presented in Table 4-3.

96. The approach for assessment and apportioning is agreed between the Applicant and Natural England and therefore, unlike with guillemot and razorbill, separate Applicant and Natural England impacts derived from different processes are not necessary.

97. The ANS will be scaled according to the design requirements, with the success of the measure considered against the success requirements. These are explained below.

- The design requirement is the quanta that measures or suites of measures should be designed to accommodate, in order to maximise the likelihood that sufficient compensation is delivered. The design requirement for kittiwake, where calculations follow the BTO methodology, is based upon the upper confidence interval (UCI) impacts and applies a 2:1 ratio.

- The success requirement reflects what the measure or suite of measures need to deliver in order to successfully address the Project's predicted impacts. The success requirement uses the mean impact value (i.e. the most likely worst case impact) at a 1:1 ratio.

Table 4-3: Kittiwake compensation requirements calculated using the ~~Hornsea 4 and Hornsea 3 'part 2' methods~~ bespoke BTO 'staggered entry' approach.

Predicted impact	Calculation method	~~Compensation requirement (breeding~~Breeding pairs~~)~~ 1:1 ratio	~~2:~~Breeding pairs 1~~compensation~~.5:1 ratio ~~(breeding pairs)~~	~~3~~Breeding pairs 2:1 ~~compensation~~ ratio ~~(breeding pairs)~~
Mean: 15.5	~~Hornsea 4 (Applicant)~~ BTO Staggered entry success requirement	~~41.8~~ 136	~~83.7~~ 204	~~125.5~~ 278
~~15.5~~	~~Hornsea 3 'part 2' (Natural England)~~	~~102.4~~	~~204.8~~	~~307.2~~
UCI: 41.0 ~~(UCI)~~	~~Hornsea 3 'part 2' (Natural England)~~ BTO Staggered entry design requirement	~~270.9~~360	~~541.9~~540	~~812.9~~720

~~96.~~98. The ANS for the Project could be designed to deliver all of this requirement range, with the quantum required dependent on the final decision by the Secretary of State.

4.5.2 Guillemot and Razorbill

~~97.~~99. The required compensation for guillemots and razorbills based on predicted impacts using the Applicant's approach and Natural England's approach is shown in Table 4-4 and Table 4-6.

~~98.~~100. A detailed description of both approaches is provided within 20.17 Guillemot and Razorbill Compensation Quanta: Table 1 of that document compares both the Applicant's and Natural England's preferred approaches to impact assessment, including apportioning to the FFC SPA; Section 3 discusses both the Applicant's preferred method of compensation calculation, ie the Hornsea Four method using the mean impact, and Natural England's preferred compensation calculation method, ~~ie~~i.e. the Hornsea Four method using the UCI impact (REP5-167 Appendix G3 - Updated advice on seabird compensation calculations). The quantum generated by using these methods in relation to that available across the Applicants proposed range of measures is presented in detail in 24.2 The Applicant's Comments on Deadline 3 Submissions.

~~99.~~101. As Natural England are also unable to rule out AEoI on guillemot at the Farne Islands SPA, compensation requirements for the FFC SPA and Farne Islands SPA in combination, are also presented in Table 4-5.

Table 4-4: Guillemot compensation requirements for the FFC SPA.

	Impact	Compensation requirement (pairs, 1:1 ratio)
Applicant approach	18.2	80.4 (updated from 77.4)
Natural England approach	375.2	1,658.1 (updated from 1,594.3)

Table 4-5. Guillemot compensation requirements for the FFC SPA and Farne Islands SPA

	Impact	Compensation requirement (pairs, 1:1 ratio)
Applicant approach	19.9	87.9 (updated from 84.6)
Natural England approach	377.9	1670.1 (updated from 1,605.8)

Table 4-6: Razorbill compensation requirements.

	Impact	Compensation requirement (pairs, 1:1 ratio)
Applicant approach	10.5	40.8 (updated from 92.0)
Natural England approach	108.1	419.6 (updated from 946.9)

~~100.~~102. For guillemot and razorbill, the Applicant maintains that~~-~~, should compensation be required, the implementation of predator control at the Plémont Seabird Reserve (see Predator Control Evidence Base and Roadmap (document reference 7.7.5)) can deliver the full compensation requirement based on the Applicant's approach; however the additional measures in the south-west (see Additional Measures for Compensation of Guillemot and Razorbill (document reference 7.7.6)) and the ANS are measures which will be pursued were the SoS to require a higher quantum of compensation than that based on the Applicant's approach. Therefore, in the event that an AEoI is identified for either (or both) auk species, a combination of these measures could be used to deliver compensation, dependent on the final quantum deemed necessary by the Secretary of State.

4.5.3 ANS Numbers and Scale

4.5.3.1 Project alone

~~101.~~103. The provision of up to two ANS structures is secured by the DCO, which could accommodate any foreseeable requirement for compensation either at the Project alone or strategic level.

4.5.3.2 KSCP Strategic delivery

~~102.~~104. Based on the number of kittiwake requiring to be compensated for both the Project and RWE's DBSW and DBSE projects, a lower limit of the nesting space on the two offshore ANS proposed through that Plan was agreed at 2,500 nesting spaces while the upper limit was agreed to be 5,500 nesting spaces shared across two offshore ANS (delivery mechanism presented within Section 11, of the KSCP). These estimates were based on the likely feasible scale of structure based on discussions with the Steering Group and were informed by conversations with other offshore compensation projects developing offshore nesting structures. The staggering of the implementation of the two ANS and the preferred delivery scenario are discussed within section 12 of the KSCP.

~~103.~~105. It is envisaged that non-ANS measures could provide 100% of the compensation required for guillemot and razorbill under the Applicant's approach.

4.6 Funding

~~104.~~106. Costs for the design, installation and maintenance of two offshore ANS are provided in Table 4-7. The provision of up to two ANS structures is secured by the DCO and two ANS has been identified as potentially necessary to deliver the strategic compensation for kittiwake within The Crown Estate KSCP (see document 7.8). In the event that two ANS are installed the total costs shown below could be shared with other relevant projects and therefore the Project's contribution would be expected to be a maximum of 50%. The costs shown below therefore represent an upper limit. These costs are also included within the Compensation Funding Statement (document reference 7.9) which outlines how the Applicant and its ultimate parent companies would fund compensation measures should they be required.

Table 4-7: Estimated costs for the development of the offshore measure

Phase	Cost
Devex	£5,000,000
Capex	£27,100,000
Opex	£3,500,000
Total	£35,600,000

4.7 Programme

~~105.~~107. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

~~106.~~108. An indicative programme for the delivery of an ANS, two full breeding seasons prior to the turning of the first turbine (i.e. start of impact), is presented in Table 4-8 below. This lead in period is intended to allow sufficient time for birds raised on the platform to recruit to the intended colonies and begin breeding there. A lead in period of two breeding seasons is appropriate as kittiwake can breed from three years of age. In the event that WTG's become operational prior to any birds raised on the ANS recruiting to the intended sites, the Applicant is confident that any compensation debt accrued will be offset over the lifespan of the project.

Table 4-8: Indicative programme for ANS delivery in context of the project being operational.

	Year					
Activity	2025	2026	2027	2028	2029	2030
Fabrication of Artificial Nesting Structure components						
Expected DCO Outcome						
Offshore installation of ANS components						
ANS Compensation Implemented						
Turbine Commissioning, Blade Spinning, Operation						

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