



# Hornsea Project Four: Derogation Information

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## Volume B2, Chapter 7: FFC SPA: Gannet and Kittiwake Compensation Plan

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## Glossary

Term	Definition
Black-legged kittiwake biogeographic population	The east Atlantic breeding population of kittiwake which includes individuals from the Flamborough and Filey Coast SPA (Stroud <i>et al.</i> , 2016). Proposed compensation measures will be undertaken within this populations breeding and migratory range.
Compensation / Compensatory Measures	If an Adverse Effect on the Integrity on a designated site is determined during the Secretary of State's Appropriate Assessment, compensatory measures for the impacted site (and relevant features) will be required. The term compensatory measures is not defined in the Habitats Regulations. Compensatory measures are however, considered to comprise those measures which are independent of the project, including any associated mitigation measures, and are intended to offset the negative effects of the plan or project so that the overall ecological coherence of the national site network is maintained.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
European site	A Special Area of Conservation (SAC) or candidate SAC (cSAC), a Special Protection Area (SPA) or a site listed as a Site of Community Importance (SCI). Potential SPAs (pSPAs), possible SACs (pSACs) and Ramsar sites are also afforded the same protection as European sites by the National Planning Policy Framework – para 176 (Ministry of Housing, Communities and Local Government, 2019). European offshore marine sites are also referred to as "European sites" for the purposes of this document.
Habitats Regulations	The Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017
Habitats Regulations Assessment (HRA)	A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European sites. The process consists of up to four stages: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI) and compensatory measures.
Hornsea Project Four Offshore Wind Farm	The term covers all elements of the project (i.e. both the offshore and onshore). Hornsea Four infrastructure will include offshore generating stations (wind turbines), electrical export cables to landfall, and connection to the electricity transmission network. Hereafter referred to as Hornsea Four.
Offshore Ornithology Engagement Group (OOEG)	The Hornsea Four Offshore Ornithology Engagement Group means the group that will assist, through consultation the undertaker in relation to the delivery of each compensation measures as identified in the gannet and kittiwake compensation plan and the gannet razorbill and guillemot compensation plan. Matters to be consulted upon to be determined by the Applicant and will include site selection, project/study design, methodology for implementing the measure, monitoring, and adaptive management options as set out in the gannet and kittiwake compensation plan and the gannet razorbill and guillemot compensation plan.
National Site Network	The network of European Sites in the UK. Prior to the UK's exit from the EU and the coming into force of the Conservation of Habitats and Species

Term	Definition
	(Amendment) (EU Exit) Regulations 2019 these sites formed part of the EU ecological network known as "Natura 2000".
Northern gannet biogeographic population	The east Atlantic breeding population of gannet which includes individuals from the Flamborough and Filey Coast SPA (Stroud <i>et al.</i> , 2016). Proposed compensation measures will be undertaken within this population's breeding and migratory range.
Orsted Hornsea Project Four Ltd.	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm Development Consent Order (DCO).
Planning Inspectorate (PINS)	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
Report to Inform Appropriate Assessment	The information that the Competent Authority needs to inform an Appropriate Assessment at Stage 2 of the HRA process and which has been provided by the Applicant in [the RIAA ( <a href="#">Volume 2, Annex 2: Report to Inform Appropriate Assessment</a> )].
Special Area of Conservation (SAC)	Strictly protected sites designated pursuant to Article 3 of the Habitats Directive (via the Habitats Regulations) for habitats listed on Annex I and species listed on Annex II of the directive.
Special Protection Area (SPA)	Strictly protected sites designated pursuant to Article 4 of the Birds Directive (via the Habitats Regulations) for species listed on Annex I of the Directive and for regularly occurring migratory species.
The Hornsea Four Offshore Ornithology Engagement Group	The Hornsea Four Offshore Ornithology Engagement Group means the group that will assist, through consultation the undertaker in relation to each compensation measure, site selection, project/study design, methodology for implementing the measure, monitoring, and adaptive management options as identified in the gannet and kittiwake compensation plan and the gannet razorbill and guillemot compensation plan.

## Acronyms

Acronym	Definition
AEOI	Adverse Effect on Integrity
cSAC	Candidate Special Area of Conservation
DCO	Development Consent Order
FFC	Flamborough and Filey Coast
GKIMP	Gannet and Kittiwake Compensation Implementation and Monitoring Plan
HRA	Habitats Regulations Assessment
MMO	Marine Management Organisation
NFFO	National Federation of Fisheries Organisation
OOEG	Offshore Ornithology Engagement Group
PINS	Planning Inspectorate
pSACs	Possible Special Area of Conservation
pSPAs	Potential Special Protection Area
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds

Acronym	Definition
SAC	Special Area of Conservation
SCI	Site of Community Importance
SNCBs	Statutory Nature Conservation Bodies
SoS	Secretary of State
SPA	Special Protection Area
UK	United Kingdom

## 1 Introduction

### 1.1 Background

- 1.1.1.1 Orsted Hornsea Project Four Limited (hereafter the 'Applicant') is proposing to develop Hornsea Project Four Offshore Wind Farm (hereafter 'Hornsea Four'). Hornsea Four will be located approximately 69 km offshore the East Riding of Yorkshire in the Southern North Sea and will be the fourth project to be developed in the former Hornsea Zone. Hornsea Four will include both offshore and onshore infrastructure including an offshore generating station (wind farm), export cables to landfall, and connection to the electricity transmission network. Detailed information on the project design can be found in [Volume A1, Chapter 1: Project Description](#), with detailed information on the site selection process and consideration of alternatives described in [Volume A1, Chapter 3: Site Selection and Consideration of Alternatives](#).
- 1.1.1.2 The Hornsea Four Agreement for Lease (AfL) area was 846 km<sup>2</sup> at the Scoping phase of project development. In the spirit of keeping within Hornsea Four's approach to Proportionate Environmental Impact Assessment (EIA), the project has given due consideration to the size and location (within the existing AfL area) of the final project that is being taken forward to Development Consent Order (DCO) application. This consideration is captured internally as the "Developable Area Process", which includes Physical, Biological and Human constraints in refining the developable area, balancing consenting, and commercial considerations with technical feasibility for construction.
- 1.1.1.3 The combination of Hornsea Four's Proportionality in EIA and Developable Area Process has resulted in a marked reduction in the array area taken forward at the point of DCO application. Hornsea Four adopted a major site reduction from the array area presented at Scoping (846 km<sup>2</sup>) to the Preliminary Environmental Information Report (PEIR) boundary (600 km<sup>2</sup>), with a further reduction adopted for the Environmental Statement (ES) and DCO application (486 km<sup>2</sup>) due to the results of the PEIR, technical considerations and stakeholder feedback. The evolution of the Hornsea Four Order Limits is detailed in [Volume A1, Chapter 3: Site Selection and Consideration of Alternatives](#) and [Volume A4, Annex 3.2: Selection and Refinement of the Offshore Infrastructure](#).
- 1.1.1.4 The Applicant is submitting an application for a DCO to the Planning Inspectorate (PINS), supported by a range of plans and documents including an ES which sets out the results of the EIA. The Applicant is also submitting a Report to Inform Appropriate Assessment (RIAA) ([B2.2: Report to Inform Appropriate Assessment](#)) which sets out the information necessary for the competent authority to undertake a Habitats Regulations Assessment (HRA) to determine if there is any Adverse Effect on Integrity (AEol) on the national site network.
- 1.1.1.5 This document sets out the Compensation Plan for black-legged kittiwake *Rissa trydactyla* (kittiwake) and northern gannet *Morus bassanus* (gannet) associated with the Flamborough and Filey Coast (FFC) Special Protection Area (SPA). Collectively it has been termed the Kittiwake and Gannet Compensation Plan. It has been developed in support of Hornsea Four in the instance that the Secretary of State does not agree with the conclusions of the Applicant's Report to Inform Appropriate Assessment (RIAA) in relation to the impact on kittiwake from the operation of the proposed wind farm.

- 1.1.1.6 Specifically, this plan sets out how the compensation measure of artificial nesting, for kittiwake and gannet can be secured at the time of DCO being granted (should the Secretary of State determine that compensation is required). In addition, this plan sets out the resilience measure for kittiwake and gannet compensation through fish habitat enhancement. It is important to note at this stage that the site selection, detailed design, monitoring and adaptive management of the proposed compensation and resilience measures would be developed in consultation with the Hornsea Four Offshore Ornithology Engagement Group (OOEG) and outlined in the Gannet and Kittiwake Implementation and Monitoring Plan (GKIMP) for approval by the Secretary of State post-consent. The ongoing site selection and design ([B2.7.5: Compensation measures for FFC SPA Artificial Nesting Site Selection and Design](#)) considers the preferred location(s) for the artificial nesting measure and the detailed design to ensure the adequacy of design for the scale of compensation required (see [Table 2 of B2.6: Compensation measures for FFC SPA Overview](#)).
- 1.1.1.7 Further details on the precise delivery methodology for the measure would be provided in a Gannet and Kittiwake Compensation and Implementation and Monitoring Plan (GKIMP) submitted to the Secretary of State prior to the operation of any wind turbine generator<sup>1</sup>. The GKIMP would be approved by the Secretary of State in consultation with the MMO/local planning authority and Natural England prior to the operation of any wind turbine generator. An outline version of the GKIMP (which details its proposed content) is presented in [B2.7.6: Outline Gannet and Kittiwake Compensation Implementation and Monitoring Plan](#).

## 1.2 Predicted Effects

- 1.2.1.1 This Kittiwake and Gannet Compensation Plan relates to the potential collision effect for kittiwake and the potential collision and displacement effect for gannet mortality from the operation and maintenance phase of Hornsea Four. The predicted magnitude of this impact on the kittiwake and gannet features of the FFC SPA is presented in Table 2 of [B2.6: Compensation measures for FFC SPA Overview](#).
- 1.2.1.2 The Applicant has undertaken a robust RIAA ([B2.2: Report to Inform Appropriate Assessment](#)) and concluded that based on the available evidence relating to the potential for collision mortality to kittiwake and for collision and displacement for gannet, it does not consider there to be potential for adverse effect on integrity (AEol) on the conservation objectives the FFC SPA either from the project alone or in-combination.
- 1.2.1.3 Table 2 of [B2.6: Compensation measures for FFC SPA Overview](#) presents the species impact levels, compensation numbers, compensation measure ratio and percentage of current breeding population relative to FFC SPA.

## 1.3 Compensation Measures

- 1.3.1.1 In the event that the Secretary of State is unable to reach a conclusion of no adverse effect on the integrity of the FFC SPA for kittiwake and gannet, the Applicant has developed a without prejudice compensation measure that could be applied (by the Secretary of State)

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<sup>1</sup> "operation of any wind turbine generator" means the first day on which operation of any wind turbine generator is programmed to commence.



to compensate at scalable levels for the predicted collision impact on kittiwake and the predicted collision and displacement impact upon gannet, from Hornsea Four.

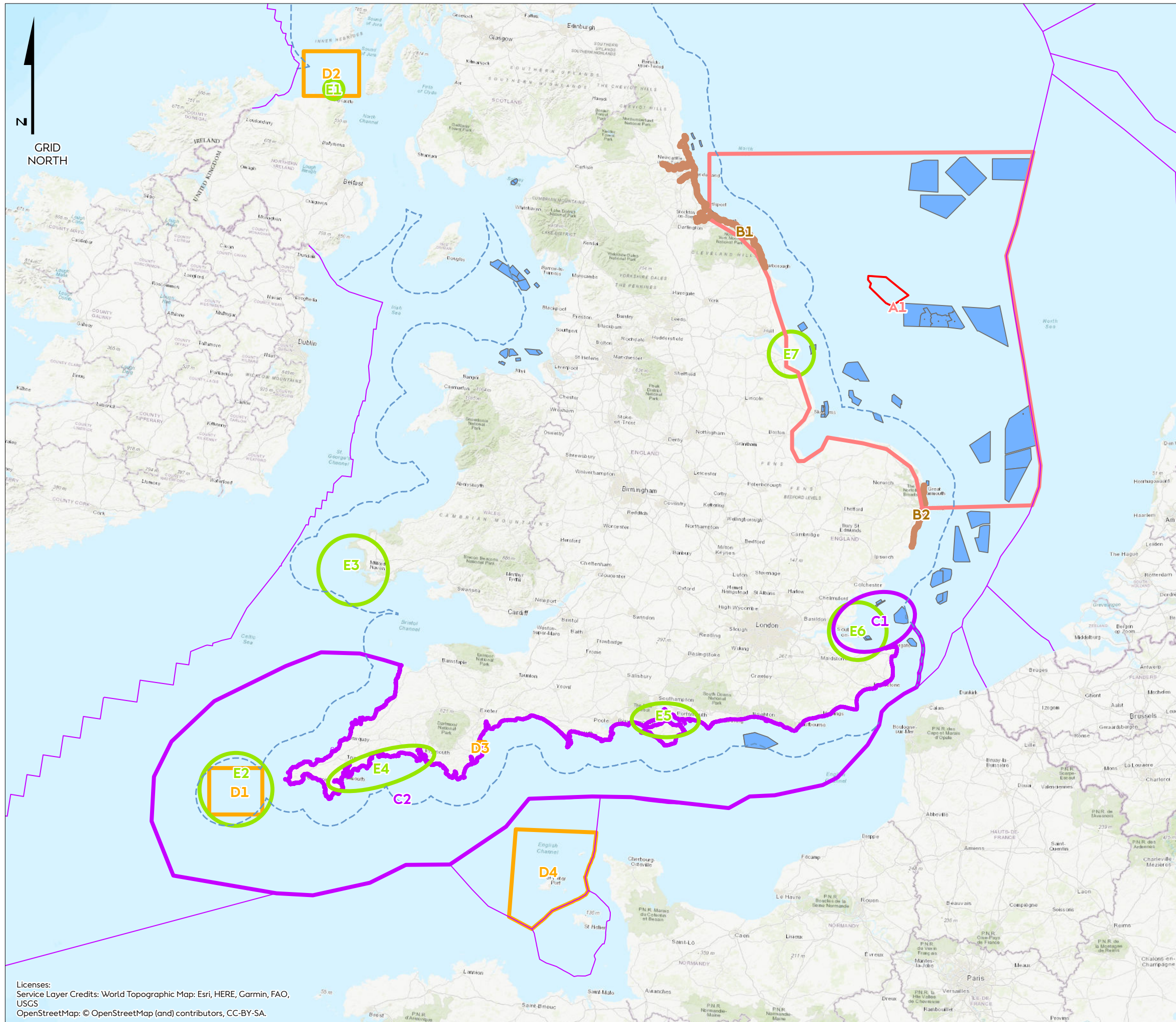
- 1.3.1.2 The proposed compensation measure for kittiwake and gannet (artificial nesting) contains a number of sub-options which are outlined in [Table 1](#) and are presented in detail in [Sections 3](#) and [4](#). The location of the search area for these measures (as well as the other compensation and resilience measures being proposed for Hornsea Four) is shown in [Figure 1](#). Hornsea Four is confident that the compensation measure is robust, deliverable, and scalable.
- 1.3.1.3 For example, in relation to the offshore structure the current indicative topside design (see [Figure 4](#) in [B2.7.5: RP Volume B2 Annex 7.5 Compensation measures for FFC SPA Artificial Nesting Site Selection and Design](#)) has been created to compensate for approximately 500 breeding pairs (anticipated maximum design scenario for nesting kittiwake pairs at time of early topside design). This is in orders of magnitude greater than the compensation levels for presented in [Table 2](#) of [B2.6: Compensation measures for FFC SPA Overview](#). The indicative topside design is scalable to provide nesting habitat for up to approximately 2,500 kittiwake breeding pairs, as a consequence of the available floor space on the preferred available offshore structure for repurposing. Furthermore, the inclusion of a resilience measure provides stakeholders with additional comfort on the level of compensation that can be provided.
- 1.3.1.4 For kittiwake and gannet, the provision of an offshore artificial nesting structure is proposed as the primary compensation measure. The Applicant's preference is supported by the acquired ecological evidence ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#)) indicating strong efficacy for a repurposed existing offshore structure for artificial nesting. However, if decided by the Secretary of State, the Applicant could provide either a new offshore or a new onshore structure as a compensation measure for kittiwake and gannet (see [Section 3](#)). As with the preferred offshore structure, the onshore structure is also scalable. In addition, as part of the suite of measures to support kittiwake and gannet (and as outlined within the Guillemot and Razorbill Plan as well), fish habitat enhancement would also be undertaken at a chosen location(s). The habitat restored (namely, seagrass) would support a number of fish species upon which kittiwake and gannet (and seabirds more generally including guillemot and razorbill) target as prey resource, therefore, this measure serves as a more indirect means to offer resilience to the kittiwake populations within the targeted area(s). The compensation measures are feasible and can be secured,
- 1.3.1.5 [Figure 1](#) illustrates the areas of search that are currently being investigated for the location of all of the compensation measures that may be required for Hornsea Four.
- 1.3.1.6 Information is presented in [Sections 3](#) and [4](#) on a measure-by-measure basis and draws on evidence presented in the associated evidence reports ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#), [B2.8.5 Compensation measures for FFC SPA: Fish Habitat Enhancement: Ecological Evidence](#)). To avoid repetition, this document should be read alongside each relevant Evidence Report. However, a brief summary of the key evidence that underpins the compensation measure is



provided in this report.

**Table 1: Compensation Measures developed by Hornsea Four for kittiwake and gannet.**

Compensation Measure	Summary
Artificial Nesting Structures: Offshore	These measures would comprise of repurposing of existing offshore nesting structure (preferred compensation measure ) or the creation of a new offshore or onshore structure to increase the annual recruitment of kittiwake and gannet into the biogeographical kittiwake and gannet populations. The location would be discussed with the OOEG (see <a href="#">Section 1.4</a> ) prior to implementation and agreed with the Secretary of State through submission of the Gannet and Kittiwake Compensation Implementation and Monitoring Plan. The implementation of the measure would be monitored and adaptive management measures develop[ed, if required.
Artificial Nesting Structures: Onshore	These measures would comprise of repurposing of existing offshore nesting structure (preferred compensation measure ) or the creation of a new offshore or onshore structure to increase the annual recruitment of kittiwake and gannet into the biogeographical kittiwake and gannet populations. The location would be discussed with the OOEG (see <a href="#">Section 1.4</a> ) prior to implementation and agreed with the Secretary of State through submission of the Gannet and Kittiwake Compensation Implementation and Monitoring Plan. The implementation of the measure would be monitored and adaptive management measures develop[ed, if required.
Fish Habitat Enhancement	This resilience measure would comprise the enhancement of a chosen site(s) where seagrass beds have been known to previously exist and works undertaken to restore (or reinstate) this habitat. The success of the reinstatement would be monitored along with the recording of increased biodiversity within the habitats including fish species.



# Hornsea Four

Annex 1

Compensation Measures Search Areas and Consultation Extent

- Hornsea Four Array Area
- Economic Exclusion Zone Boundary
- UK Offshore Windfarms
- Compensation Measures Areas of Search**
- Offshore nesting
- Onshore nesting
- Bycatch
- Predator eradication
- Seagrass



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:3,200,000

0 40 80 160 Kilometres

0 20 40 80 Nautical Miles

REV	REMARK	DATE
1	First issue	16/07/2021

Annex 1 - Compensation Measures Search Areas and Consultation Extent  
 Document no: HOW040485  
 Created by: XDAO  
 Checked by: JOHLE  
 Approved by: JULCA





## 1.4 Stakeholder Engagement

- 1.4.1.1 The Applicant has undertaken extensive consultation with relevant stakeholders (namely, Natural England, Joint Nature Conservation Committee (JNCC), the Royal Society for the Protection of Birds (RSPB), the Marine Management Organisation (MMO), the Planning Inspectorate (PINS), Defra, The Crown Estate (TCE), East Riding of Yorkshire Council (ERYC), The Wildlife Trusts, the National Federation of Fisherman's Organisations (NFFO) and relevant local organisations) on the compensation measures for Hornsea Four. Further detail on this consultation is presented in the Record of Consultation ([B2.9: Record of Consultation](#)).
- 1.4.1.2 If the Secretary of State determines that compensation is required, following the DCO being made, a Hornsea Four Offshore Ornithology Engagement Group (OOEG) would be established with core members being the relevant SNCBs and the MMO/local planning authority. The RSPB and the NFFO would also be invited to form part of the OOEG, as an advisory member. The purpose of this group would be to align on detailed site selection, design, adaptive management and monitoring to inform the delivery of the compensation post consent.
- 1.4.1.3 The Applicant would engage with and inform (as appropriate) the OOEG at least annually in the establishment phase and as needed, and as documented in GKIMP throughout the monitoring period. Terms of Reference would be agreed between the parties, which would also be submitted to the Secretary of State for approval. The Applicant would be the chair and convener of the OOEG.

## 2 Guidance

### 2.1 European Commission Guidance

- 2.1.1.1 This Kittiwake and Gannet Compensation Plan takes into consideration guidance from Defra 2012 Guidance<sup>2</sup>, Defra Best Practice Guidance for developing compensatory measures in relation to Marine Protected Areas 2021 (in consultation),<sup>3</sup> European Commission (EC) 2018 Managing Natura 2000 sites<sup>4</sup>, the Planning Inspectorate's Advice Note Ten<sup>5</sup>, precedents sets by recent cases such as the Hornsea Three DCO, the principles drawn from relevant case law, and Tyldesley and Chapman's Habitats Regulations Assessment (HRA) Handbook<sup>6</sup>. The EC 2018 guidance identifies the following criteria must be considered when developing compensatory measures:
- Coordination and cooperation between Natura 2000 authorities, assessment authorities and the proponent of the plan or project;
  - Clear objectives and target values according to the site's conservation objectives;

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<sup>2</sup> Defra (2012), Habitats and Wild Birds Directives: Guidance on the application of article 6(4) - alternative solutions, imperative reasons of overriding public interest (IROPI) and compensatory measures. December 2012. Defra Guidance Habitats regulations assessments: protecting a European site. February 2021

<sup>3</sup> Best Practice guidance for developing compensatory measures in relation to Marine Protected Areas (in consultation).

<sup>4</sup> EC (2018). Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Brussels, 21.11.2018 C(2018) 7621 final.

<sup>5</sup> Planning Inspectorate (2017). Advice Note Ten: Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects. November 2017, Version 8.

<sup>6</sup> Tyldesley, D. and Chapman C. (2013-2019). The Habitats Regulations Assessment Handbook, 2019 edition UK: DTA Publications Limited. Note that this publication is an on-line handbook that is updated periodically.

- Description of the compensatory measures, accompanied by a scientifically robust explanation of how they will effectively compensate for the negative effects and how they will ensure the overall coherence of Natura 2000 is protected;
- Demonstration of the technical feasibility of the measures in relation to their objectives;
- Demonstration of the legal and/or financial feasibility of the measures according to the timing required;
- Analysis of suitable locations and acquisition of the rights;
- Timeframe in which the compensation measures are expected to achieve their objectives;
- Timetable for implementation of compensation and co-ordination with the schedule for the project implementation;
- Public information and/or consultation stages;
- Specific monitoring and reporting schedules; and
- The financing.

2.1.1.2 These have been addressed through the subsequent sub-headings in this Kittiwake and Gannet Compensation Plan.

## 2.2 Conservation Objectives

2.2.1.1 The Conservation Objectives for the FFC SPA are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Birds Directive, by maintaining or restoring (see [B2.2: Report to Inform Appropriate Assessment](#) for further detail):

- 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 population of each of the qualifying features; and,
- The distribution of the qualifying features within the site.

2.2.1.2 Given the potential impact pathway of Hornsea Four wind farm for which compensation may be required, it is the latter two points only which are of relevance. The evidence presented within this Gannet and Kittiwake Compensation Plan and supporting annexes demonstrates that the proposed measure is predicted to more than offset the estimated impact of Hornsea Four wind farm on the qualifying kittiwake and gannet features (as determined by the Secretary of State). Whilst the measure cannot be undertaken within the FFC SPA, the birds that the compensation measure will generate will assimilate into the biogeographical kittiwake and gannet populations and thereby ensure that the coherence of the national site network is maintained. Further information to support this is provided in ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)).

## 3 Onshore and Offshore Kittiwake and Gannet Nesting Structures

### 3.1.1 Introduction

3.1.1.1 The compensation measure that the Applicant proposes to implement for kittiwake and gannet is the provision of an artificial nesting structure. This structure would be either the preferred option of repurposing an existing offshore structure or a new structure, either offshore or onshore. The following sections provide an overview of the key aspects which have been evidenced by the Applicant to date to provide the Secretary of State with sufficient confidence in onshore or offshore nesting structures as a compensation measure for Hornsea Four. This has included the following key aspects:

- Evidencing that artificial nesting structures are a viable solution for encouraging kittiwake and gannet population growth;
- Identifying suitable search areas for the siting of artificial nesting structures;
- Evidencing realistic growth rates and population dynamics associated with establishing a new colony; and
- Evidence for monitoring and adaptive measures to demonstrate the long-term sustainability of the measure.

3.1.1.2 The aim of the compensation is to provide one structure that can sustain the required breeding population of kittiwake and gannet (breeding adults) as set out in Table 2 of [B2.6: Compensation measures for FFC SPA Overview](#).

3.1.1.3 This section of the Gannet and Kittiwake Compensation Plan covers the intended plan for either offshore or onshore artificial nesting options due to the similarity between the implementation of both. Where differences between the offshore and onshore options exist, this is clearly noted and described.

3.1.1.4 While the following sections provide a brief overview of the evidence in support of the measures for kittiwake, to avoid repetition, a detailed overview of the evidence supporting this compensation measure is provided in the Onshore Nesting Structure Evidence Report and the Offshore Nesting Structure Evidence Report ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)). Therefore, the evidence reports should be read alongside this Compensation Plan.

3.1.1.5 The EC Guidance recognises that the feasibility of the identified compensation measure must be based on the best scientific knowledge available. The novelty of developing compensation for a seabird species in the UK increases the importance of pre- and post-implementation monitoring. There will, following award of consent, be a phase of further evidence gathering followed by monitoring which will continue through operation. Where necessary, monitoring, and adaptive management will ensure, in line with Guidance, that the proposals are developed in the most appropriate manner and can be flexible to enable modifications to be made where evidence suggests it is merited. These topics are covered in the following sections of the report.

3.1.1.6 Should this compensation measure be deemed necessary, the next steps required to implement it by the Applicant are set out in the Onshore Artificial Nesting Roadmap and the

Offshore Artificial Nesting Roadmap ([B2.7.2 Compensation measures for FFC SPA: Offshore Artificial Nesting Roadmap](#) and [B2.7.4 Compensation measures for FFC SPA: Onshore Artificial Nesting Roadmap](#)).

## 3.1.2 Timescales for establishment of results of measure

- 3.1.2.1 The compensation measure comprises the delivery of one artificial nesting structure in either the offshore or onshore environment (preferred option being offshore repurposed) with each capable of supporting the number of breeding pairs of kittiwake and gannet as set out in Table 2 of [B2.6: Compensation measures for FFC SPA Overview](#).
- 3.1.2.2 Based on the evidence provided in the Evidence Reports ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)), the Applicant will factor in an appropriate lead in time such that the compensatory measure will deliver the appropriate number of adult (breeding age) kittiwake and gannet into the biogeographical population to offset the impact, thereby maintaining the coherence of the national site network.
- 3.1.2.3 It is proposed that for repurposed structures (where kittiwake and gannet are already breeding either on the structure or adjacent to) the compensatory measure be provided at least one breeding season before operation of the turbines. For new artificial nesting structures, it is proposed that they are constructed so they are in place for two breeding seasons before the operation of the turbines. This departs from the precedent set by the Hornsea Three DCO, but the evidence detailed in the Evidence Reports demonstrates the viability and feasibility of this approach (see [B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)) and has been factored into the scale offered in accordance with Guidance.
- 3.1.2.4 The Applicant has developed an artificial nest design for kittiwake which draws upon the extensive ecological evidence and associated design criteria derived from this evidence to optimise the measure (see Figure 4 in [B2.7.5: Compensation measures for FFC SPA Artificial Nesting Site Selection and Design](#)). Furthermore, the Applicant is also committed to developing a detailed monitoring and adaptive management plan to track the effectiveness of the artificial nests as part of the GKIMP. If it becomes clear that some of the assumptions relating to key parameters that influence the establishment of the measure are not being realised as anticipated, adaptive management measures (see [Section 3.2.2](#)) will be implemented to improve effectiveness.

## 3.2 Monitoring Approach

- 3.2.1.1 Monitoring forms an integral component of the compensatory measure and will be discussed with relevant stakeholders through the OOEG.
- 3.2.1.2 The implementation of the kittiwake and gannet artificial nest structure will be monitored through observations of the number of return breeding birds and their subsequent breeding success. Monitoring of these rates will follow the standard methods provided by Walsh et al., (1995) and specified by the Joint Nature Conservation Committee's (JNCC) Seabird

Monitoring Programme which acts as the hub of seabird population information. All relevant monitoring data collected during the project will be contributed to the JNCC's Seabird Monitoring Programme. Collection of seabird data in this format will permit comparisons to be made with on-going monitoring at existing colonies along the east coast of England, including that undertaken by the RSPB at the FFC SPA (Babcock *et al.*, 2018). In order to monitor the number of breeding birds and their breeding success whole colony counts and productivity monitoring will be conducted at the artificial nest sites.

- 3.2.1.3 Post construction, monitoring of the artificial nesting structure will be conducted to record both breeding birds and breeding success of the first breeding season. The frequency and duration of any subsequent monitoring (while also informing adaptive management and maintenance) will be discussed in consultation with the OOEG. The precise nature of monitoring at the structure will be influenced by the final form and location the compensation measure takes, but the intention is to predominantly carry out remote monitoring using cameras on the structure. It is noted within the relevant Evidence Reports, that the exact methods required may differ between an onshore and offshore structure, but the design of the structure will seek to incorporate monitoring whilst minimising disturbance. The frequency, duration and nature of the monitoring will be discussed with OOEG members following the Applicant's decision on the refined areas of search for the structure. Monitoring will also be undertaken at adjacent existing colonies to determine whether population trends at artificial nest structure are colony or site specific. Details on how whole colony counts and productivity monitoring will be implemented are provided in the Evidence Reports ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)). The details of the monitoring will be set out within the GKIMP for approval by the Secretary of State.
- 3.2.1.4 Monitoring of the artificial nesting structure will inform the adaptive management programme (see [Section 3.2.2](#)) and influence any potential maintenance work required on the structure (either new or repurposed). With reference to adaptive management, monitoring of breeding pairs and breeding success each breeding season will likely determine the employment of adaptive management the following season.
- 3.2.1.5 In addition to the monitoring of compensation effectiveness outlined above, the deployment of an artificial nesting structure (either new or repurposed) for kittiwake and gannet presents an opportunity for research. Furthermore, providing access to birds and their nests through structure design can facilitate further research opportunities, and projects to increase understanding of adult survival. Such research could help deliver some of the research opportunities identified by stakeholders through the Offshore Wind Strategic Monitoring and Research Forum (OWSMRF) (Ruffino *et al.*, 2020). Such opportunities could include the following:
- RO3.1c - Undertake targeted empirical data collection as informed by the sensitivity analyses (RO3.1b);
  - RO3.3c - Deploying strategic adult kittiwake mark-recapture at multiple colonies, and analyses of re-sighting data (Re-trapping Adults for Survival (RAS) studies);



- RO3.3d - Deploying strategic chick mark-recapture at multiple colonies, and analyses of re-sighting data; and
- RO3.9b - Regional comparison of kittiwake diets during the breeding season: field studies.

3.2.1.6 Hornsea Project Three has already committed to delivering some of the OWSMRF research in relation to kittiwake diet and Hornsea Four could build on and complement this work. It is also important to note the Hornsea Four Outline Ornithological Monitoring Plan report ([F2.19: Outline Ornithological Monitoring Plan](#)) which outlines the proposed approach and objectives of any ornithological monitoring required by the Deemed Marine Licences (DMLs) prior to the granting of development consent. The report considers both kittiwake and gannet along with other seabird species (including guillemot and razorbill).

3.2.1.7 As stated above, the monitoring taken forward will be consulted on with the OOEG and detailed in the GKIMP that will be submitted for approval prior to the commencement of the authorised project.

## 3.2.2 Adaptive Management

3.2.2.1 Adaptive management is an iterative, post-consent process which combines management measures and subsequent monitoring with the aim of improving effectiveness whilst also updating knowledge and improving decision making over time. Adaptive management will be an important component of the compensation measure and will address unforeseen issues or deviations from expected time scales (i.e. colonisation rate of structure). Any adaptive measures will be thoroughly discussed and explored with relevant stakeholders as part of the OOEG prior to the implementation of any option. Further detail on each adaptive management option is presented in Evidence Report ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)). All known issues and risks will be mitigated through good design of the structure and routine maintenance.

3.2.2.2 Multiple adaptive management measures will be explored prior to the construction of the artificial nesting structure as it is important to consider the differences between intelligent structure design (which is covered in a separate section) and maintenance activity<sup>7</sup>, and adaptive management. The site selection process gives weight on locations where productivity for kittiwake and gannet in relation to prey availability is favourable and the population is expanding to give confidence that this would not be an issue, especially in the short to medium term.

3.2.2.3 For kittiwake, acknowledging that there is natural large inter-annual variability in prey resource (forage fish recruitment), there may be short term (1-2 years) opportunities if required, to enhance the availability of prey at or adjacent to the structure (either new or repurposed) in the breeding season. This is discussed in more detail in the Evidence Reports ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)) and within the Supporting Evidence for Seabird Prey Resource report

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<sup>7</sup> It is worth noting at this stage that ad-hoc maintenance, not linked to adaptive management, to the structure will also be highlighted by the monitoring plan. This will allow any remedial works or repairs to be conducted during the non-breeding season when breeding birds are not present at the structure (further information is provided in the relevant Evidence Report).

([B2.6.2 Compensation Measures for FFC SPA: Prey Resource Evidence](#)) exact methods will be discussed with the OOEG. In the mid to long term, the results of diet studies together with fisheries data (Inshore Fisheries and Conservation Authorities (IFCA), International Council for the Exploration of the Sea. (ICES) etc.) could be used to inform temporary measures to increase productivity at the structures.

- 3.2.2.4 The data collected will be shared with relevant advisors and authorities in order to inform consideration of fisheries management by UK government if required. Any long-term challenges to the effectiveness of the artificial nest structure relating to prey resource should be viewed in a North Sea context and in the context of natural variability, climate change and other pressures. In the event that the Applicant, in consultation with the OOEG, concludes that the artificial nesting structure is ineffective in delivering compensation and after all adaptive management options relating to the performance of the structures have been exhausted, the Applicant will consult with the OOEG with the aim of identifying alternative long-term compensation measures that are securable, deliverable and proportionate to the impact on the kittiwake and gannet at FFC SPA. In such circumstances, the Applicant will update the GKIMP and will carry out the updated Plan as approved. Adaptive management measures are designed to support the compensation measure once functioning (post construction) as a way of furthering the success and supporting resilience of the measure (Evidence Reports ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#))). As mentioned above, adaptive management will be linked closely to the monitoring plan, the full detail of which will be agreed through the OOEG and set out within the GKIMP.

### 3.2.3 Implementation Criteria

- 3.2.3.1 As set out in the Evidence Reports ([B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence](#), [B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)), provision of additional artificial nesting opportunities for kittiwakes and gannet within the specified search zones is expected to enhance productivity and therefore be effective as a compensatory measure to meet Article 6(4) requirements. The establishment of breeding colonies at the structure would produce young that would become part of the wider biogeographic population of kittiwake. The success of the measure will be determined by the required number of nesting pairs breeding on the structure and productivity rate. This will be reviewed within the context of variability in breeding success and how it can be driven by external factors and therefore, success will be considered over time.
- 3.2.3.2 As identified at the outset of this Gannet and Kittiwake Compensation Plan, it is anticipated that the Secretary of State will determine the level of effect based on the Appropriate Assessment conclusions for the potential impact of Hornsea Four on the breeding adult kittiwake associated with the FFC SPA. The Applicant's current position is presented in Table 2 of [B2.6: Compensation measures for FFC SPA Overview](#).
- 3.2.3.3 The compensation measure is a long-term commitment, with monitoring and adaptive management built in to ensure the long-term success of the measure. A key function of the

OoEG will be to help define appropriate and proportionate monitoring and adaptive management in relation to the compensation. A timeframe will be developed with the above considerations in mind to ensure not only that the delivery of the measure is as planned, but that relevant monitoring of kittiwake and gannet is undertaken at appropriate timescales to maximise its usefulness to the project and the wider scientific community.

- 3.2.3.4 In order to benefit the wider scientific community, the Applicant would look to consider collaboration on monitoring with Hornsea Three and potentially other developers who are also providing onshore nesting structures. This would maximise the usefulness of proposed monitoring programmes.

### 3.2.4 Site Selection

- 3.2.4.1 A significant amount of site selection work has already been completed for the proposed artificial nesting structure as part of the Hornsea Three compensation process (Niras, 2020). This has looked at ecological, land acquisition and technical constraints and requirements. A similar process is described in the Site Selection and Design report ([B2.7.5 Artificial Nesting: Site Selection and Design](#); and [B2.7.3 Onshore Artificial Nesting: Ecological Evidence](#)). A summary of this work is presented below.

#### Onshore Site Selection

- 3.2.4.2 The Onshore Site Selection and Pathway to Securement (Niras, 2020) report undertaken for Hornsea Three resulted in the identification of two preferred search zones within which further work is being undertaken to establish specific sites on which artificial nests will be developed.
- 3.2.4.3 The search area, Caton Bay to Newbiggin by the Sea is being further considered for Hornsea Four, in addition to East Suffolk, to establish specific sites on which artificial nests will be developed. The constraints and requirements established as a part of the site selection process have been led by the evidence-based approach outlined in the Evidence Report ([B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)). Initial consultation will commence with the relevant local planning authorities, conservation and ornithological groups with local knowledge and expertise. A full account of the ecological criteria for the site selection process undertaken to date is provided within the Onshore Site Selection and Pathway to Securement (Niras, 2020) with reference to the Evidence Report ([B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence](#)). The purpose of site selection has been to identify an area to host artificial nesting sites that will be occupied by new recruits in the English southern North Sea, whilst contributing to an increase of breeding adults to the biogeographic kittiwake and gannet populations. The principles influencing this initial site selection work as detailed in the Onshore Site Selection and Pathway to Securement (Niras, 2020) comprise:
- Locations which kittiwake and gannet will be able to find (for example either locations where there are existing (smaller) populations of kittiwake and gannet, or where there are factors which attract kittiwake);
  - Locations where there is evidence of stable/increasing productivity and evidence of an expanding population (as a proxy for favourable prey resource);

- Locations where there is a lack of existing natural or man-made suitable nesting habitat (locations where kittiwake and gannet are attempting to nest in unfavourable conditions such as ground nesting at RSPB Minsmere are particularly promising);
- Waterfront locations away from urban housing which minimise human interaction and where purpose built artificial nests can ideally overhang water, to mimic natural nesting conditions as far as possible.

3.2.4.4 For an area of search in the onshore to nearshore environment the key steps to land acquisition have been identified below. However, in the event that voluntary agreement with the relevant landowner(s) cannot be reached, compulsory acquisition powers are available to the Applicant. Orsted Hornsea Project Three (UK) Limited advanced Phase 1 and the Applicant can therefore rely upon the draft shortlist of sites as drawn up by Orsted Hornsea Project Three (UK) Limited and focus upon Phase Two as set out below in [Figure 2](#).

**Phase One:**



**Phase Two:**



**Figure 2: Phase One and Phase Two of developing a shortlist of sites for artificial nesting structures.**

3.2.4.5 The detail of the continued site selection process will be presented within the GKIMP that will be developed in consultation with relevant stakeholders (through the OOEG).

Offshore Site Selection

3.2.4.6 Offshore artificial nesting for kittiwakes and gannet is being developed for Hornsea Four, therefore no previous plans or projects have undertaken a site selection evaluation for this compensation approach.

3.2.4.7 The site selection process for the offshore artificial nesting structure is being undertaken via a heatmapping exercise. Ecological criteria is a primary consideration, with technical and commercial parameters also considered in the site selection analysis. A full account of the criteria for the site selection process undertaken to date is provided in [B2.7.5 Compensation measures for FFC SPA: Artificial Nesting: Site Selection and Design](#).

3.2.4.8 Following the heatmapping process described above, a potential area of highest ecological opportunity measuring 140 km by 70 km has been identified. This area will be further refined

following application informed by technical, environmental, and commercial considerations as well as consultation with relevant stakeholders. Supporting this, geophysical surveys and geotechnical investigations will be undertaken in 2022 to inform the selection of a precise location, to ensure suitable ground conditions for construction.

### 3.3 Design and Construction

3.3.1.1 Any new structure is most likely to be bespoke or a modification to an existing building or piece of infrastructure (such as a seawall or offshore platform) which is currently colonised. The design will also vary depending on the onshore or offshore location. The onshore structure design will likely be influenced by landowner negotiations, landscape character, and existing environment of the selected location. Hornsea Four will apply the results of ongoing Hornsea Three consultation on design as a starting point, to avoid repetition.

#### Onshore Design

3.3.1.2 The Applicant is confident that there is sufficient empirical evidence of successful examples of both bespoke structures and modifications to existing structures (see Evidence Report [\(B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence\)](#)) that whichever solution is required it will be successful providing it meets the key design criteria, based on kittiwake ecology, as follows:

- Physical design elements:
  - Horizontal ledges 20 cm by 30 cm;
  - Vertical back wall;
  - Walls or partitions between groups of nests and overhang or roof to buffer weather conditions (while maintaining visibility of neighbouring birds); and
  - Height above nesting ledge >30 cm.
- Location:
  - Nest adjacent to / above harbour waters / sea
  - >2 m above ground/mean high water level
  - Avoid faces which would be overly exposed to adverse weather e.g. strong winds, rain or sun depending on locality.

3.3.1.3 The design will be adapted to be suitable for gannet in appropriate areas of the nesting structure. The following broad design concepts are all considered to have the potential to meet the necessary design criteria (with full detail being provided in the Evidence Report [\(B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence\)](#)) and will be considered within the GKIMP:

- Purpose built structure or tower with ledges accessible and visible from inside;
- Allocation of existing flat area and landscaping using flat slabs of granite or similar to replicate rock they naturally nest on;
- Decoy nests and playback calls to encourage colonisation; and
- Gannets should have an uninterrupted approach.

3.3.1.4 The Applicant will consult with the OOEG when developing the final design for the structure and draw upon the number of examples presented in the Evidence Report as well experience that will have been gained in Hornsea Three [\(B2.7.3 Compensation measures for FFC SPA:](#)

**Onshore Artificial Nesting: Ecological Evidence**) to ensure there is opportunity for stakeholders to feed into the process, with the final scheme set out in the GKIMP. An initial analysis which considers the different design options used at existing kittiwake and gannet examples is included in the Evidence Report (**B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence**).

3.3.1.5 The initial structure design will allow for appropriate monitoring, adaptive management measures and any maintenance which may be required. Constructing a nesting structure which allows access to the nests would allow for enhanced monitoring and research opportunities. This information will be provided within the GKIMP, along with the evidence on which it is based. Furthermore, information in relation to health, safety, and environment considerations, including health and safety during monitoring will also be provided in-line with industry standards.

#### Offshore Design

3.3.1.6 The Applicant is currently considering either construction of a new offshore structure or repurposing of an existing offshore structure, such as a platform which is due for decommissioning. Examples of ledges on offshore rigs show that they fulfil many of the natural nesting requirements for kittiwake and gannet and may provide additional benefits e.g. fewer predators and are closer to food sources (Christensen-Dalsgaard 2019).

3.3.1.7 A detailed review of onshore nest site characteristics and parameters can be found in the kittiwake and gannet compensation case produced for Hornsea Project Three (NIRAS, 2020). A summary of these key features which are equally applicable to an offshore environment include:

- High and steep sided structure, narrow horizontal ledge for nests, small overhang above nest;
- Inaccessible to predators, which offshore would primarily be large gulls;
- Some shelter from high winds and other adverse weather conditions; and
- Presence of other breeding kittiwakes and gannet (this would initially be achieved by providing decoys and playback of kittiwake and gannet calls to encourage colonization of a structure).

3.3.1.8 When adapting to an offshore environment, consideration will be taken for the wave splash zone and height above sea surface, this will be dependent on location,

3.3.1.9 At offshore sites, birds appear to choose narrow ledges under helidecks and walkways, mainly on unmanned platforms. Unmanned platforms are typically accessed infrequently, so are likely to have lower disturbance from human activity and provide some protection from predation by large gulls as the helideck forms a ceiling. However, birds also breed on manned platforms e.g. Norway and Morecambe Bay, and seem to habituate to regular human activities/presence (Christensen-Dalsgaard *et al.* 2019). The Evidence Report (**B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence**) provides a comprehensive overview of features of sites where birds have nested on offshore platforms. The Applicant will consult with the OOEG when developing the final design for the structures (or repurposing of existing structure) and draw upon the number of examples presented in the Evidence Report (**B2.7.1 Compensation measures for FFC SPA: Offshore**

**Artificial Nesting: Ecological Evidence**) to ensure there is opportunity for stakeholders to feed into the process, with the final scheme set out in the GKIMP. An initial analysis which considers the different design options used at existing kittiwake examples is included in the Evidence Report (**B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence**).

3.3.1.10 The initial structure design (or design for repurposing) will allow for appropriate monitoring, adaptive management measures and any maintenance which may be required. This information will be provided within the GKIMP, along with the evidence on which it is based. Furthermore, information in relation to health, safety, and environment considerations, including health and safety during monitoring will also be provided in-line with industry standards.

### 3.3.2 Implementation programme

3.3.2.1 The activities required to carry out the actions set out above (which would be outlined in the GKIMP) are well understood due to the experience of Hornsea Three and extensive construction, licensing and consenting in both the offshore and onshore environment. Hornsea Four are planning to undertake site investigation surveys during 2022 to refine the site selection and carry out detailed design. The Applicant would seek to develop the measures as soon as possible following a legally secure consent decision, with all surveys being complete prior to Financial Investment Decision. The GKIMP would be submitted to the Secretary of State for approval in consultation with relevant key stakeholders.

3.3.2.2 Further details on the timelines of the compensation measure are presented in the Onshore Artificial Nesting Roadmap and the Offshore Artificial Nesting Roadmap (**B2.7.2 Compensation measures for FFC SPA: Offshore Artificial Nesting Roadmap and B2.7.4 Compensation measures for FFC SPA: Onshore Artificial Nesting Roadmap**). The Applicant has designed the compensation measures to be effective and deliverable.

## 4 Resilience Measures – Fish Habitat Enhancement and prey resource<sup>8</sup>

### 4.1 Introduction

4.1.1.1 As part of the suite of compensation to support the kittiwake, gannet, guillemot and razorbill primary compensation measures, fish habitat restoration is proposed to be undertaken as a resilience measure at a chosen location(s). The habitat restored (namely, seagrass) would support a number of fish species upon which kittiwake, gannet, guillemot and razorbill (as well as other seabird species) target as prey resource, therefore, this measure serves as a more indirect means to offer resilience to the kittiwake, gannet, guillemot and razorbill populations within the targeted area(s). This resilience measure is feasible and can be secured.

4.1.1.2 Hornsea Four have undertaken an extensive review of the evidence base supporting the use of this measure. The results of this review are presented in the accompanying Fish Habitat Enhancement Evidence Report **B2.8.5 Compensation measures for FFC SPA: Fish Habitat**

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<sup>8</sup> Hornsea Four are in the process of discussing potential seagrass restoration projects with several partners. These discussions are currently commercially sensitive, and this section will be updated in due course once further details can be disclosed.



**Enhancement: Ecological Evidence.** The Evidence Report covered utilisation of seagrass habitats by key prey fish species associated with guillemot, razorbill, gannet, and kittiwake and assessed how enhancing forage fish species may increase seabird prey resource. It highlights the importance of seagrass habitat and provides evidence of seagrass meadows functioning as a nursery for juvenile forage fish species, the importance of this habitat for prey fish species for the three seabird species noted above and seagrass habitat restoration methodology.

- 4.1.1.3 This section should also be read alongside the fish habitat enhancement roadmap ([B2.8.6 Compensation measures for FFC SPA: Fish Habitat Enhancement: Roadmap](#)) which sets out the next steps that will be undertaken should this measure be required.

## 4.2 Seagrass Restoration Projects

- 4.2.1.1 Seagrass restoration projects have been undertaken for over 50 years (MMO, 2019). For example in Chesapeake Bay in the US, 3000 hectares of seagrass have been restored since the first survey in 1984 from once lifeless habitats, with rapid recovery of their ecosystem services now being observed (Orth *et al.* 2020). The restored seagrass meadows in Chesapeake Bay have recorded rapidly increasing ecosystem service provision from maturing restored seagrass meadows that have become indistinguishable from natural meadows (Orth *et al.* 2020).
- 4.2.1.2 In recent years, a number of seagrass restoration projects have been undertaken in the UK. Project Seagrass and Swansea University led the UK's first major restoration project in Dale in West Wales. Organisations are undertaking research and trials to expand the remaining 20ha of seagrass at Spurn Point Nature Reserve. Yorkshire Wildlife Trust are undertaking trials to discover the optimal conditions for gathering and germinating seagrass seeds (Yorkshire Wildlife Trust, 2021).
- 4.2.1.3 In Plymouth Sound and the Solent the largest restoration project began in April 2021, a partnership project led by Ocean Conservation Trust (OCT) and involving Natural England, and numerous other stakeholders and volunteers (OCT, 2021). The project aims to plant seagrass bags across a total of eight hectares of seagrass meadows – four hectares in Plymouth Sound and four hectares in the Solent Maritime Special Area of Conservation. By planting seagrass, the project hopes to create more seagrass meadows which provide homes for juvenile fish and protected creatures like seahorses and stalked jellyfish (OCT, 2021).
- 4.2.1.4 The Applicant is exploring opportunities to expand existing seagrass restoration projects that are already underway and opportunities to create new projects with the academic community that could potentially add resilience to the primary compensation measures. These broad locations are illustrated in [Figure 1](#).

## 4.3 Seagrass Restoration Techniques

- 4.3.1.1 Seagrass restoration has been carried out for over 50 years and the means of doing this can principally be split into two major techniques:

- replanting ; and
- reseeding.

- 4.3.1.2 Both techniques have their relative merits and have exhibited varying levels of success. Reseeding and replanting techniques have sometimes been used together. Using seeds in conjunction with adult plants may in some instances prove more effective (van Katwijk *et al.* 2016). A broad overview of the literature illustrates that although a lot is now known about seagrass restoration, there are research gaps and as a result the success rate of restoration projects can vary, demonstrating that prior to commencement, it is vital that studies are undertaken to assess the feasibility and site selection and ensure the efficacy of the measure (Unsworth & Butterworth, 2021).
- 4.3.1.3 The use of reseeding generally relates to the collection and targeted redistribution (and sometimes processing) of wild seed. Adult shoot replanting normally involves harvesting plants from an existing meadow and transplanting them to the restoration site. The reproductive fronds of wild seed is collected by hand by SCUBA divers. The seeds collected by recent projects have obtained permits/consent from Natural England and Natural Resources Wales. Recent reports from the Environment Agency highlight the need for seagrass restoration to increasingly depend upon nursery grown propagules.
- 4.3.1.4 In most cases, shoot planting involves some means of anchoring the shoots to the bottom until the roots can take hold (root into the bottom). Replanting uses either labour intensive diving techniques or various mechanistic approaches to planting various sizes and ages of seagrass plants into new localities. Planting of seedlings in the UK is typically undertaken by a team of divers who are transported to the site by boat. Seeds can also be directly deployed from the boat and often hessian bags are used to help anchor the seeds in place during germination. It is expected that up to two vessels would be required for the seagrass restoration at each location.
- 4.3.1.5 Seagrass restoration requires consideration of a range of factors necessary to make it a success. A recent review of the success of restoration projects globally found that success relates to the severity of the habitat degradation (van Katwijk *et al.* 2016). Seeds, adult plants, and sods are not significantly different, although seedlings show lower success rates. A short distance to the donor site is also related to success.
- 4.3.1.6 Some seagrass restoration projects particularly the trials of small/medium sized projects have funding secured. The Applicant will look to fund additional areas for seagrass restoration that do not currently have funding secured and therefore provide additional benefit rather than projects that are part of normal practice and site/habitat management of the designated sites. Evidence gathering by the Applicant is ongoing and discussions with stakeholders on restoration projects and techniques is continuing. However, currently all types of restoration methods are being considered and may be combined using the best techniques at the time of restoration for the greatest success.

## 4.4 Location

- 4.4.1.1 Exploration of potential broad areas for seagrass restoration is ongoing. The main areas that are being considered consistently support all of the target seabird species and provide

options for seagrass restoration as well as supporting other compensation measures, therefore increasing the resilience of the measures.

- 4.4.1.2 From April to July (breeding season), both guillemot and razorbill are located tightly around their colonies (around the coasts of the UK except for the Humber to the Isle of Wight). Outside of the breeding season, both species move further offshore, then start moving south. By December both species are located offshore around all UK coasts. As seabird distributions change throughout the year, the composition of their prey can also change, for example guillemot have a more varied diet in winter (Furness and Tasker, 2000). It will therefore be important to evaluate temporal variations when undertaking site selection analysis for the purpose of planning compensation measure locations.
- 4.4.1.3 Potential existing seagrass meadows located within proximity to the primary razorbill and guillemot compensation measures i.e. bycatch and predator eradication, with reported connectivity with the wider site network and the North Sea populations include the Solent, Channel Islands, Cornwall, Isles of Scilly, Essex, Rathlin Island and Humber Estuary (see [Figure 1](#)). All of these locations are being considered for potential feasibility trails and future implementation. The locations taken forward may depend on the chosen locations of primary compensation measures.

## 4.5 Implementation, operation, monitoring and adaptive management

- 4.5.1.1 Prior to any field studies commencing, detailed feasibility studies would be undertaken to assess the physical parameters for seagrass to be restored and undertake further stakeholder engagement. The Applicant recognises the need for feasibility studies to consider site selection and methodology to increase the likelihood of a successful restoration programme and efficacy of the compensation measure. Factors that would be considered prior to restoration efforts being initiated to ensure the viability of seagrass restoration include looking for sites:
- being sheltered from wave action;
  - with suitable topographical and hydromorphological conditions including sedimentation rates;
  - sufficient nutrients and available light;
  - good water quality; and
  - avoid sites with activities that could cause significant physical disturbance.
- 4.5.1.2 Surveys may be required to establish the levels of activity at the potential locations. Planting seagrass at sites previously known to support seagrass and known to have appropriate conditions for seagrass would likely result in increased biodiversity and ecosystem service provision (Unsworth, 2021). Part of the site selection process would take evidence of previous seagrass locations as a key consideration (Green *et al.*, 2021).
- 4.5.1.3 For a new restoration project, physical surveys (e.g. particle size, depth, slope, light, temperature, total suspended solids, redox layer) and biological surveys may be conducted as well as habitat mapping at each site, these could involve the use of camera drops and diver surveys to assess the suitability of the potential locations. When undertaking site selection studies the health and nutrient status of the closest seagrass meadows or patch

would be examined.

- 4.5.1.4 It may be necessary, especially with the potential scale restoration, that a series of surveys would be needed to identify potential seagrass meadows for future seed collections. This would be conducted in consultation with Natural England and other stakeholders. When planning the restoration project the focus would be on facilitating natural recovery through alleviating recruitment limitation.
- 4.5.1.5 The Applicant would undertake studies to understand the most appropriate scale for any resilience measure and consider how to maximise the benefits of spatial overlap/proximity to the other compensation measures. The Applicant recognises the importance of encouraging long-term survival by promoting self-facilitation through implementation at a large-enough scale. The Applicant would ensure that significant contingency, which may include reseeded/replanting, is built into the measure to provide the necessary confidence that it would have sufficient resilience, offset the impact and efficacy as a compensation measure.
- 4.5.1.6 Engagement with statutory and non-statutory bodies and local stakeholders and landowners would be undertaken to share and discuss our ambitions, plans and to ensure the success of the measures. The Applicant would work with academics and organisations with experience of previous restoration projects in order to ensure that activities build on the outcomes of best practice and lessons learnt.
- 4.5.1.7 Following the site suitability surveys, a site selection process (potentially using a decision matrix) would be used to select the optimal site(s) for restoration. Environmental baseline surveys of the site(s) would be undertaken so that change over time can be assessed accordingly. Restoration of the seagrass using replanting and/ or reseeded methods would be undertaken following the methodology devised through engagement with academics and stakeholders. A pilot trial planting scheme is likely to be undertaken particularly for any new restoration location. Following the feasibility trials to gather further evidence on the efficacy of the seagrass restoration, the sites and methods would be selected to take forward.
- 4.5.1.8 There are several seagrass restoration projects being considered by a number of organisations in the UK and it may be that a project has already undertaken the required site selection and trials and is looking for the resource to undertake a larger scale scheme.
- 4.5.1.9 The Applicant has been discussing these options with academics and stakeholders and has identified a suitable project that is already underway that the Applicant could contribute towards to expand the restoration project. During 2021/2022, the Applicant is planning to fund a trial at a proposed restoration site. The trial would be up to 2 ha in size and the Applicant is funding seed collection in 2021 in order to facilitate this trial.
- 4.5.1.10 The Applicant is confident that the measures extensive large-scale seagrass restoration (up to a total of 30 ha) would provide resilience to the measures and compensate as part of a suite of measures for Hornsea Four. Implementation of the seagrass restoration project would begin following determination of the DCO application by the Secretary of State if required. All necessary permissions and consents would be obtained.

4.5.1.11 It is recognised that there are knowledge gaps on the specific linkages between seagrass in the UK and non-grazing seabirds and the level of the role of seagrass supporting forage fish for seabirds such as razorbill, guillemot, gannet, and kittiwake. Nonetheless, there is clear evidence of the ecological benefits of seagrass and for prey species. Whilst the broad understanding of the links between seagrass meadows and fisheries are well understood (Kritzer *et al.* 2016; Unsworth *et al.* 2019), there is currently limited evidence for this role at a UK level, with most data collected from only a handful of sites (Bertelli and Unsworth 2014; Peters *et al.* 2015). Understanding about temporal and spatial variability is also lacking (Unsworth and Butterworth, 2021). Whilst it is known that forage fish species clupeids, gadoids and sand eels all utilise UK seagrass meadows at periods of the life cycle the nature of this role hasn't been quantified (Unsworth and Butterworth, 2021). The Evidence Report (**B2.8.5 Compensation measures for FFC SPA: Fish Habitat Enhancement: Ecological Evidence**) sets out the ecological evidence for fish habitat enhancement as a compensation measure in further detail.

4.5.1.12 A key component of the fish habitat enhancement compensation measure will be research, to gather evidence to contribute towards filling these knowledge gaps. The Applicant has identified a number of initial potential research projects which could be undertaken (in addition to feasibility studies) including:

- Foraging seagrass habitat study for seabirds including species counts, behavioural observations and habitat mapping;
- Fish surveys within seagrass meadows using seine and/or fyke netting; and
- Migratory fish tagging to understand fish movements.

4.5.1.13 These research topics will be explored in greater detail and a research programme will be devised to support of the measures, with many of these projects starting in 2021/2022.

4.5.1.14 Hornsea Four is expected to operate for 35 years following construction. Monitoring of restoration will be essential to demonstrate the efficacy of the compensation measure and if required, the seagrass meadow would be monitored throughout the operational lifespan of Hornsea Four. The exact method of monitoring and frequency would be decided based upon further evidence gathering and discussion with restoration experts and stakeholders. A monitoring programme would be developed, and at key stages the results of the restoration would be shared to improve the knowledge base for seagrass restoration.

4.5.1.15 Adaptive management is an iterative process which combines management measures and subsequent monitoring with the aim of improving effectiveness whilst also updating knowledge and improving decision making over time. Adaptive management would be an important component of the resilience measure and would be used as a method to address unforeseen issues or deviations from expected time scales (i.e. additional infill planting required).

## 4.6 Summary of Fish Habitat Enhancement Next Steps

4.6.1.1 In summary, the Applicant is proposing to fund the expansion of an existing restoration project that is already underway. During 2022, the Applicant is planning to fund a trial at

this proposed restoration site. The trial would be up to 2 ha in size and the Applicant is funding seed collection in 2021 in order to facilitate this trial. Implementation of the seagrass restoration project would begin following determination of the DCO application by the Secretary of State if required.

- 4.6.1.2 The restoration of seagrass is considered an effective, feasible and securable measure that can be implemented prior to the impact occurring and sustainable for the life-time of the project. In designing this compensation measure the Applicant has consulted and worked with Natural England, JNCC, the RSPB, The Wildlife Trusts, other statutory bodies and academics, Natural England, JNCC, the RSPB, The Wildlife Trust, other statutory bodies, and other relevant stakeholders to ensure this compensation measure is both robust and deliverable.

## 5 Draft DCO Wording

### Schedule [ ]

#### Ornithology Compensation Measures

##### PART 1

#### The Hornsea Four Offshore Ornithological Engagement Group

1. In this Schedule:

“The FFC” means the site designated as the Flamborough and Filey Coast Special Protection Area;

“the gannet and kittiwake compensation plan” means the document certified as the gannet and kittiwake compensation plan by the Secretary of State for the purposes of this Order under article 38 (certification of plans and documents etc.);

“the gannet guillemot and razorbill compensation plan” means the document certified as the gannet razorbill and guillemot compensation plan by the Secretary of State for the purposes of this Order under article 38 (certification of plans and documents etc.);

“the Hornsea Four Offshore Ornithology Engagement Group” or “H4 OOEG” means the group that will assist, through consultation, the undertaker in the delivery of the compensation measures identified in the gannet and kittiwake compensation plan and the gannet razorbill and guillemot compensation plan;

“the offshore compensation measures” means, as the context requires, bycatch reduction and/or the offshore nesting structure(s); and

“the onshore compensation measures” means, as the context requires, predator eradication and/or predator control measures and/or the onshore nesting structure(s).

2. Work Nos. 1, 2, 3, 4 and 5 together with any associated development offshore may not be commenced until a plan for the work of the “H4 OOEG” has been submitted to and approved by the Secretary of State. Such plan to include:
- a) terms of reference of the H4 OOEG;
  - b) details of the membership of the H4 OOEG which must include:
    - i. the MMO and the relevant statutory nature conservation body as core members for offshore compensation measures and
    - ii. the relevant local planning authority and statutory nature conservation body as core members for onshore compensation measures;
    - iii. the RSPB and The Wildlife Trust and the National Federation of Fishermens Organisations as advisory members, for both onshore compensation measures and/or offshore compensation measures subject to their area of expertise;
  - c) details of the proposed schedule of meetings, timetable for preparation of the gannet and kittiwake implementation and monitoring plan (“the KGIMP”) and the gannet, guillemot and razorbill implementation and monitoring plan (“GGRIMP”) and reporting and review periods;
  - d) the dispute resolution mechanism and confidentiality provisions;
  - e) the scope of the H4 OOEG to be limited to the topics for discussion as identified by the Applicant as chair of the H4 OOEG to include in relation to each compensation measure, site selection, project/study design, methodology for implementing the measure, monitoring and adaptive management options.

## PART 2

### Gannet and Kittiwake Compensation Measures

3. The GKIMP must be submitted to the Secretary of State for approval in consultation with the MMO and relevant statutory nature conservation body for offshore compensation measures (if required), and with Natural England and the relevant local planning authority for onshore compensation measures (if required). The KGIMP must be based on the strategy for gannet and kittiwake compensation set out in the gannet and kittiwake compensation plan and include:
- a) details of locations where compensation measures will be deployed, and in the event onshore structures are required, details of landowner agreements and in the event new offshore structures are required, details of the seabed agreements with the relevant owner of the foreshore;
  - b) details of designs of artificial nesting structure(s); and how risks from avian or mammalian predation and for onshore nesting structures how unauthorised human access will be mitigated;
  - c) an implementation timetable for delivery of the artificial nesting structure, such timetable to ensure that in the event of the implementation of:
    - i. a new or repurposed onshore or offshore structure that does not host an existing colony, the structure is in place to allow for two kittiwake and gannet breeding



seasons prior to operation of any turbine forming part of the authorised development; or

- ii. a repurposed onshore or offshore structure that hosts an existing colony the structure is in place to allow for one kittiwake and gannet breeding season prior to operation of any turbine forming part of the authorised development;

For the purposes of this paragraph each breeding season is assumed to have commenced on 1 April in each year and ended on 31<sup>st</sup> August.

- d) details of the proposed ongoing monitoring of the measures including: survey methods; survey programmes and colony and productivity counts;
  - e) recording of H4 OoEG consultations;
  - f) details of any adaptive management measures, with details of the factors used to trigger any such measures;
  - g) provision for reporting to the Secretary of State, to include details of the use of each site by breeding kittiwake and gannet to identify barriers to success and target any adaptive management measures;
  - h) details of the artificial nesting site maintenance schedule for the artificial nesting structure; and
  - i) in the event that the undertaker must implement bycatch reduction measures for gannet the information listed in paragraph 9(b)
4. The undertaker must construct the compensation measures as set out in the GKIMP approved by the Secretary of State.
  5. The undertaker must notify the Secretary of State of completion of implementation of the measures set out in the GKIMP.
  6. The artificial nest structure must not be decommissioned without prior written approval of the Secretary of State.
  7. The GKIMP approved under this Schedule includes any amendments that may subsequently be approved in writing by the Secretary of State. Any amendments to or variations of the approved KGIMP must be in accordance with the principles set out in the gannet and kittiwake compensation plan and may only be approved where it has been demonstrated to the satisfaction of the Secretary of State that it is unlikely to give rise to any materially new or materially different environmental effects from those considered in the gannet and kittiwake compensation plan.

### PART 3

#### **Gannet Guillemot and Razorbill Compensation Measures**

8. The GGRIMP must be submitted to the Secretary of State for approval in consultation with the MMO and the relevant statutory nature conservation body for offshore compensation measures, and with the relevant statutory nature conservation body and the relevant local planning authority and relevant conservation trusts for onshore compensation measures. The GGRIMP must be based on the strategy for gannet, guillemot and razorbill compensation set out in the gannet guillemot and razorbill compensation plan and include:

- a) in the event that the undertaker must implement predator eradication and/or predator control measures
    - i. details of locations where compensation measures will be deployed;
    - ii. details of how any necessary access rights, licences and approvals have or will be obtained and any biosecurity measures will or have been secured;
    - iii. an implementation timetable for delivery of the predator eradication and/or predator control measure that ensures that the measure has been implemented two years prior to operation of any turbine forming part of the authorised development;
    - iv. proposals for monitoring and reporting on the effectiveness of the measures, including productivity rates; breeding population and distribution of breeding birds;
    - v. recording of H4 OoEG consultations;
    - vi. details of any adaptive management measures, with details of the factors used to trigger any such measures; and
    - vii. provision for reporting to the Secretary of State, to include details of the use of each site by breeding guillemot and razorbill to identify barriers to success and target the adaptive management measures.
  - b) in the event that the undertaker must implement bycatch reduction measures
    - i. details of relevant technology supply agreements and arrangements with fishers to uptake the bycatch reduction technology that will or has been secured;
    - ii. an implementation timetable for provision of the bycatch reduction measures that ensures that the measures are in place prior to the operation of any turbine forming part of the authorised development;
    - iii. proposals for monitoring and reporting on the effectiveness of the measures, including the collection of data from participating fishers;
    - iv. recording of H4 OoEG consultations;
    - v. details of any adaptive management measures and details of the factors used to trigger adaptive management measures for each species; and
    - vi. provision for annual reporting to the Secretary of State, to identify barriers to success and target the adaptive management measures.
9. The undertaker must implement the compensation measures as set out in the GGRIMP approved by the Secretary of State.
10. The undertaker must notify the Secretary of State of completion of implementation of the measures set out in the GGRIMP.
11. The GGRIMP approved under this Schedule includes any amendments that may subsequently be approved in writing by the Secretary of State. Any amendments to or variations of the approved GGRIMP must be in accordance with the principles set out in the gannet, guillemot and razorbill compensation plan and may only be approved where it has been demonstrated to the satisfaction of the Secretary of State that it is unlikely to give rise to any materially new or materially different environmental effects from those considered in the kittiwake compensation plan.

#### PART 4

### Fish Habitat Enhancement

12. No turbine forming part of the authorised development may begin operation until the fish habitat enhancement measures have been implemented in accordance with the principles as set out in the GKIMP and the GGRIMP (as relevant).

## 6 Funding

- 6.1.1.1 The Applicant has identified the costs associated with the development, implementation, and ongoing monitoring of the proposed measures. These costs have been included within a detailed Funding Statement (**B2.10: The Without Prejudice Derogation Funding Statement**). This statement is supplemental to the Funding Statement submitted as part of the suite of Application documents (**Volume E.1.1 Funding Statement**). The Without Prejudice Derogation Funding Statement outlines the overall project cost based on the capital expenditure and operational expenditure assumptions in the "Review of Renewable Electricity Generation Cost and Technical Assumptions" (DECC, 2016). The Without Prejudice Derogation Funding Statement also details the corporate structure and a robust explanation to allow the SoS to conclude that the necessary funding to deliver the measures can be secured.

## 7 Conclusion

- 7.1.1.1 This document sets out the Compensation Plan for black-legged kittiwake *Rissa tridactyla* (kittiwake) and northern gannet *Morus bassanus* associated with the FFC SPA. Collectively it has been termed the Gannet and Kittiwake Compensation Plan. It has been developed in support of Hornsea Four should the Secretary of State disagree with the conclusions of the Applicant's RIAA in relation to the impact and find that adverse effects on the integrity of the FFC SPA cannot be ruled out.
- 7.1.1.2 The proposed compensation measures for kittiwake are outlined below in **Table 2**.
- 7.1.1.3 For kittiwake and gannet, the provision of an artificial nesting structure is proposed as a potential compensation measure. The preferred artificial nesting structure would be an offshore repurposed existing structure, but the Applicant has also considered both a new offshore structure and an onshore structure, if required by the Secretary of State (see **Section 3**). In addition, as part of the package of measures to support kittiwake and gannet (and as outlined within the Gannet, Guillemot and Razorbill Compensation Plan as well), fish habitat enhancement would also be undertaken at a chosen location(s). The habitat restored (namely, seagrass) would support a number of fish species upon which kittiwake and gannet (and seabirds more generally including guillemot and razorbill) target as prey resource, therefore, this measure serves as a more indirect means to offer resilience to the kittiwake and gannet populations within the targeted area(s).
- 7.1.1.4 Hornsea Four are confident that the compensation measures are securable, deliverable and proportionate to the impact on the FFC SPA. The inclusion of a resilience measure provides stakeholders with additional comfort. Hornsea Four have presented detailed reviews of the evidence base supporting each of the compensation measures which can be found in the following documents: (**B2.7.1 Compensation measures for FFC SPA: Offshore Artificial**

Nesting: Ecological Evidence, B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence, B2.8.5 Compensation measures for FFC SPA: Fish Habitat Enhancement: Ecological Evidence).

7.1.1.5 In terms of next steps, should these compensation measures be required, a roadmap document has been produced for each measure which details the process that would be undertaken for delivery of the measure. These roadmaps accompany the DCO application and are [B2.7.2 Compensation measures for FFC SPA: Offshore Artificial Nesting Roadmap](#) and [B2.7.4 Compensation measures for FFC SPA: Onshore Artificial Nesting Roadmap](#)).

**Table 2: Compensation Measures developed by Hornsea Four for kittiwake and gannet.**

Compensation Measure	Summary
Artificial Nesting Structures: Offshore	These measures would comprise of repurposing of existing offshore nesting structure or the creation of a new offshore or onshore structure to increase the annual recruitment of kittiwake and gannet into the biogeographic region. The location would be discussed with the OoEG (see <a href="#">Section 1.4</a> ) prior to implementation and agreed with the Secretary of State through submission of the Gannet and Kittiwake Compensation Implementation and Monitoring Plan. The success of the measure would be monitored and adaptive management measures implemented, if required.
Artificial Nesting Structures: Onshore	These measures would comprise of repurposing of existing onshore nesting structure or the creation of a new onshore or offshore structure to increase the annual recruitment of kittiwake and gannet into the biogeographic region. The location would be discussed with the OoEG (see <a href="#">Section 1.4</a> ) prior to implementation and agreed with the Secretary of State through submission of the Gannet and Kittiwake Compensation Implementation and Monitoring Plan. The success of the measure would be monitored and adaptive management measures implemented, if required.
Fish Habitat Enhancement	This measure would comprise the restoration of a chosen site(s) where seagrass beds have been known to previously exist and works undertaken to restore (or reinstate) this habitat. The success of the reinstatement would be monitored along with the recording of increased biodiversity within the habitats including fish species.

7.1.1.6 The compensation measures are viable, effective, feasible and can be secured and delivered to successfully compensate for the potential impacts of Hornsea Four.

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