Hornsea Project Four

A4.6.5: Compensation EIA Annex Part 1-6

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Prepared GoBe Consultants Ltd. & Royal HaskoningDHV, August2022
Checked Sarah Randall Orsted, August 2022
Accepted Francesca De Vita Orsted, August 2022
Approved Julian Carolan, Orsted, August 2022

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01	N/A	N/A	Document submitted at application.
02	Updated throughout	Updated throughout	Updated based on the most recent compensation proposal details and to reflect the refinement of Areas of Search for the different measures.

Non-Technical Summary

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. The Applicant is proposing a suite of Compensation Measures that could be implemented in the event that the Secretary of State (SoS) concludes that there would be an Adverse Effect on Integrity (AEoI) on the Flamborough and Filey Coast (FFC) Special Protection Area (SPA) as a result of Hornsea Four alone and/ or in combination with other plans or projects. These Compensation Measures are presented 'without prejudice' for guillemot and razorbill features, however for kittiwake, where AEoI has been concluded for potential in-combination effects, this ('without prejudice' case) does not apply. For full details on the background to Hornsea Four and the compensation measures see **A4.6.1 Compensation Project Description** (Deadline 7 submission) and **Section 4** below.

The 'without prejudice' (with exception of kittiwake) Compensation Measures are being considered to provide compensation for a number of species of seabird and across a number of locations where the measures could be located, termed 'Areas of Search' (AoS), with these summarised below. Note that fish habitat enhancement is referred to as a resilience measure.

Compensation Measure	Option	Location	Location ID	Kittiwake	Guillemot	Razorbill
Offshore nesting	New	Southern North Sea (Area of Highest Ecological Potential)	A1			
Offshore nesting	Repurposed	Southern North Sea (Wenlock platform)	A1			
Onshore nesting	New	Cayton Bay to Newbiggin by the Sea	B1			
Bycatch	-	South coast of England	C1			
Predator eradication	-	Bailiwick of Guernsey	D1			
Fish habitat enhancement[1]	Seagrass	Humber Estuary	E1			

The process of identifying the type, location and extent of potential compensation measures has considered a number of alternatives to date. Consideration of these commenced in spring 2020, with the preparation of a long list of options. These were consulted on in June 2020, with the subsequently revised short list presented to stakeholders for consultation in autumn 2020. Further work since then has refined the compensation and resilience measures included here for assessment. The consideration of alternatives is described in more detail in **Section 3**. It is expected that further work will continue to refine the compensation measures under consideration.

[1] Fish habitat enhancement is a resilience measure to support the compensation measures.

To ensure all potential impacts that may result from the installation/ construction, implementation/ operation/ maintenance, and decommissioning, a Compensation Impacts Register has been established (see **Section 6.3** and **A4.6.3 Compensation Impacts Register** (Deadline 7 submissions) for more detail). This is presented as an Excel spreadsheet and includes the following:

- All potential impacts associated with each Compensation Measure, with a unique identification reference which can be traced through the subsequent steps/documents;
- Sets the scope of the Compensation Measures EIA with appropriate justification;
- States the magnitude, sensitivity and significance for all potential impacts associated with all activities, in all phases of development of each Compensation Measure;
- Identifies Commitments to reduce or eliminate LSE; and,
- Defines the Maximum Design Scenario (MDS) for any given impact.

The Impact Register covers the breadth of Environmental Impact Assessment (EIA) topics (encompassing natural environment and human environment) and across all stages of each of the compensation and resilience measures.

A cornerstone of the Hornsea Four assessment process is the establishment of the Compensation Measures Commitments Register (see **Section 4.1.3** and **A4.6.4 Compensation Commitments Register** (Deadline 7 submission)). As advocated in EIA guidance (e.g. IEMA 2004), it is only necessary to assess potential effects arising from the final design, incorporating all primary and tertiary mitigation (only pre-mitigation effects and residual effects need to be both set out where secondary mitigation is required). In this respect, the Applicant has considered the Commitments in making an initial assessment of the likely significant effects.

The Commitments Register includes Commitments that provide the justification for potential effects to be scoped out of the assessment and are sufficient to ensure that all the impacts in the Impacts Register can be mitigated sufficiently to ensure no potential likely significant effect will result in all cases. As such, the potential effects to all receptors and for all the compensation or resilience measures are therefore **not significant** in terms of the EIA Regulations (**A1.5 Environmental Impact Assessment Methodology (APP-011)**).

The assessment provided in this document is based on the current understanding of the location, scope and nature of the proposed Compensation Measures. It should be noted, however, that ultimately, the Compensation Measures will not be consented through the Hornsea Four DCO application process and will be subject to (where necessary) standalone EIA and HRA processes as part of their own consenting process (for example a Marine Licence application and/or Planning Application). As part of that consenting process, further assessment work will be undertaken, based on refined design and methodology details.

Table of Contents

List of Tables

List of Figures

Glossary

Term	Definition
Area of Search	A term used to identify the locations for each of the proposed primary Compensation Measures.
Commitment	A term used interchangeably with mitigation and enhancement measures. The purpose of Commitments is to reduce and/or eliminate Likely Significant Effects (LSEs), in EIA terms. Primary (Design) or Tertiary (Inherent) are both embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, Preliminary Environmental Information Report (PEIR) or ES). Secondary commitments are incorporated to reduce LSE to environmentally acceptable levels following initial assessment i.e. so that residual effects are acceptable.
Compensation Commitment Register	An Excel spreadsheet which identifies all of the commitments identified for consideration when assessing/ implementing the proposed compensation measures. The compensation commitments relate to both onshore and offshore, and includes the construction, operation and decommissioning phases of development for the proposed Compensation Measures. Document reference: **Volume A4, Annex 6.4: Compensation Commitments Register** (Deadline 7 submission).
Compensation Impacts Register	An Excel spreadsheet which identifies all of the potential effects that the project team have identified that could possibly result from the construction, operation and decommissioning of the Compensation Measures, relating to each technical topic under consideration in the EIA process. See **Volume A4, Annex 6.3 Compensation Impacts Register (**Deadline 7 submission**)** for more details.
Compensation Measures	The measures that have been developed by the Applicant pursuant to the HRA Derogation Provisions "without prejudice" to the Applicants position of no Adverse Effect on Site Integrity at the Flamborough and Filey Coast in respect of the qualifying features. The Compensation Measures are: offshore and onshore nesting; predator eradication; bycatch and fish habitat enhancement measures. Each a Compensation Measure and together Compensation Measures.
Cumulative effects	The combined effect of Hornsea Four in combination with the effects from a number of different projects, on the same single receptor/resource. Cumulative impacts are those that result from changes caused by other past, present or reasonably foreseeable actions together with Hornsea Project Four.
Design Envelope	A description of the range of possible elements that make up the Hornsea Project Four design options under consideration, as set out in detail in the project description. This envelope is used to define Hornsea Project Four for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with

Term	Definition
	the value, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Impact Assessment (EIA) Report.
Environmental Statement (ES)	A document reporting the findings of the EIA and produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.
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.
Landfall	The generic term applied to the entire landfall area between Mean Low Water Spring (MLWS) tide and the Transition Joint Bay (TJB) inclusive of all construction works, including the offshore and onshore ECC, intertidal working area and landfall compound. Where the offshore cables come ashore east of Fraisthorpe.
Maximum Design Scenario (MDS)	The maximum design parameters of each Hornsea Four compensation measure (both on and offshore) considered to be a worst case for any given assessment.
Mitigation	A term used interchangeably with Commitment(s) by Hornsea Four. Mitigation measures (Commitments) are embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, or PEIR or ES).
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).
SSSI	Site of Special Scientific Interest
TCE	The Crown Estate
UKHO	UK Hydrographic Office

Acronyms

Term	Definition
AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AEoI	Adverse Effect on Integrity
AfL	Agreement for Lease
AIAA	Areas of Intense Air Activity
AONB	Area of Outstanding Natural Beauty
AoS	Area of Search
AQMAs	Air Quality Management Areas
AWDS	Above Water Deterrents
BEIS	Department for Business, Energy & Industrial Strategy
BAP	Biodiversity Action Plan
CBRA	Cable Burial Risk Assessment
CCS	Carbon Capture and Storage
DBCB	Dogger Bank Creyke Beck
DCO	Development Consent Order
DP	Dynamic Positioning
ECC	Export Cable Corridor
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
ES	Environmental Statement
FFC	Flamborough and Filey Coast
HEMS	health emergency medical services
HGV	Heavy Goods Vehicle
HRA	Habitats Regulations Assessment
IAQM	Institute of Air Quality Management
JNCC	Joint Nature Conservation Committee
JUV	Jack Up Vehicles
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effect
LW	Low Water
MBES	Multi-Beam Echo Sounder
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MPA	Marine Protected Area
NFFO	National Federation of Fisherman's Organisations
O&G	Oil and Gas
O&M	Operations and Maintenance
OOEG	Offshore Ornithology Export Topic Group
PEIR	Preliminary Environmental Information Report
PEMMP	Project Environmental Marine Management Plan
PINS	The Planning Inspectorate
PLA	Port of London Authority

Term	Definition
PSA	Particle Size Analysis
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SoS	Secretary of State
SPA	Special Protection Area
SNCBs	Statutory Nature Conservation Bodies
SoS	Secretary of State
SPA	Special Protection Area
SSS	Side-Scan Sonar
TCE	The Crown Estate
TPOs	Tree Preservation Orders
UK	United Kingdom
UKHO	UK Hydrographic Office
UXO	Unexploded Ordnance
WSI	Marine Written Scheme of Archaeological Investigation

Units

Unit	Definition
dB	Decibel (sound pressure)
ft	Feet (distance)
Ha	Hectares (distance)
Hz	Hertz (frequency)
km	Kilometre (distance)
Km^2	Kilometre squared (distance)
m	Metre (distance)
m^2	Metre squared (distance)
nm	Nautical Mile (distance)

1 Introduction

1.1 Project 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 **A1.4: Project Description (REP6-002)**, with detailed information on the site selection process and consideration of alternatives described in **A1.3: Site Selection and Consideration of Alternatives (APP-009)**.

1.1.1.2 The Hornsea Four Agreement for Lease (AfL) area was 846 km^2 at the Scoping phase of project development. In the spirit of keeping with 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^2) to the Preliminary Environmental Information Report (PEIR) boundary (600 km^2), with a further reduction adopted for the Environmental Statement (ES) and DCO application (468 km^2) due to the results of the PEIR, technical considerations and stakeholder feedback. The evolution of the Hornsea Four Order Limits is detailed in **A1.3: Site Selection and Consideration of Alternatives (APP-009)** and **A4.3.2: Selection and Refinement of the Offshore Infrastructure (APP-037)**.

1.1.1.4 The Applicant has submitted (September 2021) a DCO application to the Planning Inspectorate (PINS), supported by a range of plans and documents including an ES which sets out the results of the EIA of Hornsea Four and its associated infrastructure. The Applicant has also submitted a Report to Inform Appropriate Assessment (RIAA) (**B2.2: Report to Inform Appropriate Assessment (REP5-012; REP2-005; AS-013; REP1-012 and APP-171 – APP-178)**) which sets out the information necessary for the competent authority (the Secretary of State (SoS) for the Department for Business, Energy & Industrial Strategy (BEIS)) to undertake an Appropriate Assessment (AA) to determine if there is any Adverse Effect on Integrity (AEoI) on the national site network as a result of the development of Hornsea Four (alone and or in-combination). Should the conclusion of that AA be AEoI (or there is uncertainty around this), that would raise the requirement for the Applicant to consider subsequent stages of the Habitats Regulation Assessment (HRA) process (typically referred to as the derogations), which brings a requirement, among other considerations, to secure compensatory measures.

1.1.1.5 In accordance with the Habitats Regulations, the RIAA (**B2.2: Report to Inform Appropriate Assessment (REP5-012; REP2-005; AS-013; REP1-012 and APP-171 – APP-178)**) considers whether Hornsea Four could result in an AEoI on a conservation site of European importance (European site). The Applicant's RIAA concluded that Hornsea Four will potentially have an AEoI, in combination, on the kittiwake feature of the Flamborough and Filey Coast (FFC) SPA. No AEoI was concluded for all other European site features.

1.1.1.6 During the consideration of the DCO application for Hornsea Three Offshore Wind Farm (Hornsea Three), the SoS clarified the importance of i) identifying the potential for AEoI of designated sites during the pre-application period and ii) considering the need for derogation of the Habitats Regulations during examination, where there is potential for AEoI. The SoS further expected Applicants and Statutory Nature Conservation Bodies (SNCBs) to engage constructively during the pre-application period and on these matters, including possible compensatory measures, for consideration during examination. The SoS was clear that this does not require that an agreement is reached between the Applicant and the SNCBs on the potential for significant adverse impacts on designated sites, and that evidence relating to derogation can be provided on a "without prejudice" basis, as the final decision on such matters remains with the SoS.

1.1.1.7 As such, the Applicant is proposing a suite of Compensation Measures that could be implemented in the event that the SoS concludes that there would be an AEoI on the Flamborough and Filey (FFC) Coast Special Protection Area (SPA) as a result of Hornsea Four. These Compensation Measures are set out in a 'without prejudice' Derogation Case which forms part of the DCO Application (**A4.6.1 Compensation Project Description** (Deadline 7 submission)). However, the Applicant has since revised its RIAA conclusion for kittiwake to AEoI in-combination. Therefore, the Compensation Measures presented remain "without prejudice", with the exception of those proposed for kittiwake.

1.1.1.8 The potential Compensation Measures are set out in **Table 1** with further details on the measures set out in **A4.6.1 Compensation Project Description** (Deadline 7 submission). The Compensation Measures are proposed to be located in numerous areas of the UK and beyond (see **Figure 1**).

Table 1: Potential 'Without Prejudice' Compensation Measures for Hornsea Four.

Compensation Measure	Option	Location	Location ID	Kittiwake	Guillemot	Razorbill
Offshore nesting	New	Southern North Sea (Area of Highest Ecological Potential)	A1			
Offshore nesting	Repurposed	Southern North Sea (Wenlock platform)	A1			
Onshore nesting	New	Cayton Bay to Newbiggin by the Sea	B1			
Bycatch	-	South coast of England	C1			
Predator eradication	-	Bailiwick of Guernsey	D1			
Fish habitat enhancement[2]	Seagrass	Humber Estuary	E1			

[2] Fish habitat enhancement is a resilience measure to support the compensation measures.

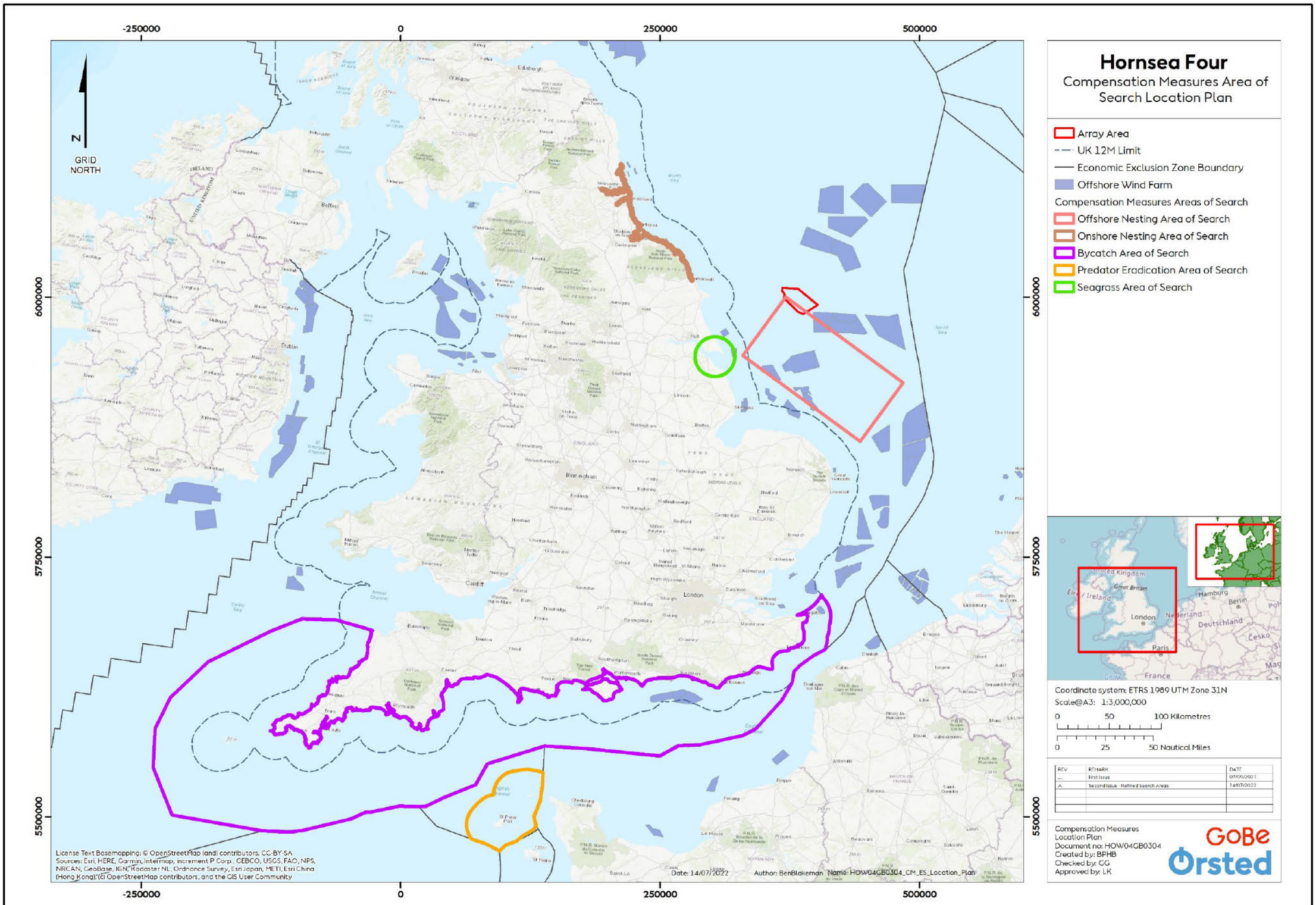


Figure 1: Compensation Measures Areas of Search Location Plan.

1.2 Purpose of this Document

1.2.1.1 In order to consider the environmental impacts associated with the implementation of the proposed Compensation Measures, this Annex to the Hornsea Four ES has been produced (hereafter 'the Compensation Measures EIA'), accompanied by a Habitats Regulations Assessment (**B2.2.2 Habitats Regulations Assessment Compensation Measures** (Deadline 7 submission)- 'the Compensation Measures HRA'). The focus of the EIA is on the assessment of the likely significant environmental effects.

1.2.1.2 The assessment provided in this document is based on the current understanding of the location, scope and nature of the proposed Compensation Measures. It should be noted, however, that ultimately, the Compensation Measures will not be consented through the Hornsea Four DCO application process and will be subject to (where necessary) standalone EIA and HRA processes as part of their own consenting process (for example a Marine Licence application and/or Planning Application). As part of that consenting process, further assessment work will be undertaken, based on refined design and methodology details.

1.3 Structure of this Document

1.3.1.1 This Compensation Measures EIA is set out in a number of stages as follows:

- Policy and Legislation (**Section 2**)
- Consideration of Alternatives (**Section 3**);
- A brief summary of the potential Compensation Measures for Hornsea Four (**Section 4**);
- Consultation (**Section 5**);
- A brief summary of the EIA Methodology used for the assessment (**Section 6**);
- An EIA section for each Compensation Measure (**Section 7** to **12**), with each section containing the following sections:
    - Baseline – a summary of the baseline environment for each Area of Search (AoS);
    - Assessment – identification of impacts and associated assessment.
- Conclusions (**Section 13**); and
- References (**Section 14**).

2 Policy and Legislation

2.1.1.1 **A1.2 Planning and Policy (APP-008)** of the Hornsea Four ES sets out the international, national, region and local planning policy context in relation to Hornsea Four and the EIA process. This detail is also relevant to the Compensation Measures EIA (to the extent they are located in areas where the policy applies e.g. national policy) and as such, not repeated within this Annex. Policies specific to each EIA topic are outlined in **Volume A2, Chapter 1** to **12 (APP-013 – APP-017; REP5-004; REP5-006** and **APP-020 – APP-024)** for offshore topics and **Volume A3, Chapter 1** to **10 (APP-025 – APP-026; AS-008** and **APP-028 – APP034)** for onshore topics. Regional and local planning policies for each Compensation Measure will be considered further via the relevant consenting process (as appropriate) once final details on location are known.

3 Consideration of Alternatives

3.1.1.1 This section outlines the process undertaken by the Applicant to site selection and consideration of alternative measures and alternative site/locations for their delivery. The scope of the consideration of alternatives relates specifically and directly to the compensation measures for kittiwake, *Rissa trydactyla* and large auks (common guillemot – hereafter guillemot, *Uria aalge,* and razorbill, *Alca torda*) at Flamborough and Filey Coast Special Protection Area (FFC SPA).

3.1.1.2 An important part of the Hornsea Four development process is the consideration of potential options, selection and the subsequent refinement of compensation options and their delivery. Well informed decisions on the selection and consideration of alternatives are critical and Hornsea Four recognise the need to ensure consultees and stakeholders understand how such decisions have been made.

3.1.1.3 In spring 2020, the Applicant commenced a process to identify compensation measures to inform the 'without prejudice' Derogation Case. Initially a long list of potential options was drawn up (see **Annex B2.6.1: Compensation measures of the FFC SPA: Compensation Criteria (AS-018)**. The draft long-list was presented to stakeholders at a workshop on 24th June 2020 (see **B2.9: Record of Consultation (APP-201)**). The initial long list for kittiwakes and guillemot and razorbill are presented in **Table 2** and **Table 3** respectively.

Table 2: Long list of compensation options for kittiwake.

Habitat creation	i: Construction of an ONSHORE artificial structure to encourage a new kittiwake colony outside of FFC SPA at a location lacking suitable nesting habitat (and preferably near to foraging ground and away from OWFs).
	ii: Construction of an OFFSHORE artificial structure to encourage a new kittiwake colony outside of FFC SPA at a location lacking suitable nesting habitat (and preferably near to foraging ground and away from OWFs).
	iii: Creation of area of seabed habitat for prey spawning or nursery ground combined with management measures (potentially also to accommodate and mitigate effects of climate change on stocks) to boost prey stocks
Reserve creation	i: Designation of new marine SPA in important offshore foraging location.
Species recovery	i: Eradication of American mink from an island important to/used by kittiwake using trapping or poisoning techniques.
	ii: Eradication of feral cat from an island important to/used by kittiwake using trapping/ lethal technique.
	iii: Eradication of rat (brown rat and or black rat (and house mouse) from an island colony using trapping or poisoning techniques.
	iv: Exclusion of foxes from a colony using anti-predator fencing
	v: Exclusion of great skua from a buffer zone around a kittiwake colony
Incentives/ disincentives for certain activities	i: Management of recreational pressure at the FFC SPA (or another SPA)
	ii: Sandeel fishery exclusion zone
	iii: Sandeel fisheries exclusion zone within the Hornsea Project Four array area
	iv: Purchase of a sandeel fishery quota
	v: Work with ICES (and relevant key stakeholders) to change the sandeel quota for this region of the North Sea based on an ecosystem approach to management

Table 3: Long list of compensation for guillemot and razorbill.

Species recovery	i: Eradication of rats from an island colony of guillemot and razorbill using rodent traps or poisoned bait.
Habitat creation	i: Encourage establishment of a new colony in an area close to heightened prey availability using models and call playback.
	ii: Creation of area of seabed habitat for prey spawning or nursery ground combined with management measures (potentially also to accommodate and mitigate effects of climate change on stocks) to boost prey stocks
Incentives/ disincentives for certain activities	i: Sandeel and sprat fishery exclusion zone.
	ii: Sandeel and sprat fisheries exclusion zone within the Hornsea Project Four array area.
	iii: Purchase of a sandeel and sprat fishery quota.
	iv: Sandeel and sprat fisheries exclusion in wintering areas.
	v: Work with ICES (and relevant key stakeholders) to change the sandeel quota for this region of the North Sea based on an ecosystem approach to management
Reserve creation	i: Designation of new marine SPA at important offshore foraging location.
Reduction of other threats and pressures	i: Reduce bycatch.

3.1.1.4 The long list was presented to stakeholders in autumn 2020, with stakeholder agreement that there were no exclusions from the long list (see **B2.9: Record of Consultation (APP-201)**).

3.1.1.5 In order to evaluate the potential compensation measures in a robust and transparent manner, each of the options were evaluated against a set of criteria. The criteria are described in full in Table 3 of **B2.6.1 (APP-184)**, and summarised below[3]:

- Targeted - The compensatory measures must address the issue specifically;
- Effective – The compensatory measures must be feasible in reinstating the ecological conditions needed to ensure the overall coherence of the national site network;
- Technical feasibility – The technical feasibility of the measure taking into account requirements of the ecological features to be reinstated;
- Extent of compensation – The extent required for the compensatory measures to be effective is directly related to the quantitative and qualitative aspects inherent to the elements of integrity;
- Location of compensation - Compensatory measures should be located in areas where they will be most effective in maintaining the overall coherence of the National Site Network (note general agreement to be as close to the impacted site as feasibly possible);
- Timing of compensation – The timing of the compensation is difficult to specify and should be adapted using a case-by-case approach, and;
- Long-term implementation – The compensatory measures require a legal and financial basis for long-term implementation as well as for the protection, monitoring and maintenance of the site/species.

[3] Guidance criteria was built upon Defra Compensatory Measures guidance: Best practice guidance for developing compensatory measures in relation to Marine Protected Areas (defra.gov.uk)

3.1.1.6 The application of the criteria to the long list options is referred to as "short-listing" and was undertaken to evaluate selected compensation measures in more detail and to decide which measures to advance. The results of this short-listing exercise were presented to stakeholders in autumn 2020 (see **B2.9: Record of Consultation (APP-201)**).

3.1.1.7 The most promising options for compensation of kittiwakes were identified as:

- Habitat creation (onshore);
- Incentives/ disincentives for certain activities (change the sandeel quota);
- Habitat creation (offshore); and
- Species recovery (rat eradication).

3.1.1.8 The most promising options for compensation of guillemot and razorbill were:

- Reduction of other threats and pressures (bycatch reduction);
- Species recovery (rat eradication);
- Incentives/ disincentives for certain activities (change the sandeel quota); and
- Incentives/ disincentives for certain activities (sandeel and sprat fishery exclusion zone).

3.1.1.9 Despite the options of many different compensation measures, they vary in feasibility. The Applicant therefore took forward the following compensation measures for inclusion in the derogation case, as a result of the short-listing process combined with stakeholder feedback on the potential measures:

- Kittiwake:
  - Onshore artificial structure;
  - Offshore artificial structure; and
  - Habitat creation – seagrass restoration.
- Guillemot and razorbill:
  - Bycatch reduction;
  - Predator eradication; and
  - Habitat creation - seagrass restoration.

3.1.1.10 Areas of Search (AoS) have been identified for each Compensation Measure, with these shown in **Figure 1.** These AoS range from small areas around islands or discrete sections of coastline, to larger areas spanning large areas of sea and coastlines. The AoS identification process is detailed for each compensation measure in **A4.6.1: Compensation Project Description** (Deadline 7 submission). Information on the consultation undertaken as part of the process to date is presented within **B2.9 Record of Consultation (APP-021)**. As noted above, the extent of the AoS remains broad to incorporate sub-options and numerous locations which will be refined as the process progresses.

4 Project Description

4.1 Project Description

4.1.1 Introduction

4.1.1.1 The project description is presented for each Compensation Measure as a Maximum Design Scenario (MDS), in line with the approach taken in the ES and the RIAA. This approach ensures that the scenario(s) that would have the greatest impact, relevant to the AoS and the Compensation Measure under consideration, is identified and assessed. As a result, we can be confident that any other (lesser) scenario(s) will have an impact that is no greater than that assessed.

4.1.1.2 The following sections provide a description of the design and methodologies related to each of the proposed Compensation Measures referenced in **Table 1** and summarised below, presented as an MDS. These descriptions set out the design and components for any infrastructure, as well as the activities associated with the installation/ construction, implementation/ operation/ maintenance, and decommissioning of each Compensation Measure (where relevant). Further details on these measures can be found in **A4.6.1: Compensation Project Description** (Deadline 7 submission). The Compensation Measures are as follows:

- Offshore Artificial Nesting Structure (New and Repurposed);
- New Onshore Artificial Nesting Structure;
- Bycatch Reduction Technology;
- Predator Eradication; and
- Resilience Measure – Fish Habitat Enhancement (Seagrass).

4.1.2 Areas of Search (AoS)

4.1.2.1 As noted above, AoS have been refined for each Compensation Measure, with these shown in **Figure 1**. These AoS range from small areas around islands or discrete sections of coastline, to larger areas spanning large areas of sea and coastlines. These have been identified and the AoS identification process is detailed for each compensation measure in **A4.6.1 Compensation Project Description** (Deadline 7 submission). Information on the consultation undertaken as part of the process to date is presented within **B2.9 Record of Consultation (APP-201)**. Consultation has continued throughout the Examination processes which has facilitated and supported the refinement process. As noted above, the extent of the AoS remains broad but will be refined as the process progresses. The individual AoS for each Compensation Measure are shown in figures following each MDS.

4.1.3 Compensation Measures Commitments

4.1.3.1 All Commitments relevant to the Compensation Measures EIA are detailed in **A4.6.4: Compensation Commitments Register** (Deadline 7 submission).

4.1.4 Compensation Measures Programme

4.1.4.1 The high-level anticipated programme (may be subject to change) presented below is applicable to the implementation and delivery of all Compensation Measures:

- Hornsea Four development consent determination – 2022/23;
- Compensation implementation licencing – 2022/24;
- Compensation implementation – 2023/24;
- Offshore construction of Hornsea Four Foundations– 2026;
- Offshore construction of Hornsea Four Turbines– 2027; and
- First Power (partially operational windfarm) – 2028.

4.1.4.2 Implementation of compensation measures will be subject to successful progression of the Hornsea Four project. The timing of implementation of individual compensation measures are provisional as the timeframe for Examination, consent award, reaching final investment decision (FID) and Contracts for Difference (CfD) Allocation Round Five, have not yet been set. The programme has been carefully considered to ensure timely delivery of the compensation measure.

4.1.4.3 The requirement for, and the exact nature of, the decommissioning of the Compensation Measures will be determined in consultation with the relevant authorities towards the end of the 35-year operational life of Hornsea Four. The Applicant will design the bird nesting structure for a design life equal to that of the windfarm (i.e. 35 years plus 4 years to establish the compensation measures, pre-wind farm operation). Therefore, the lifetime of the structure is approximately 39 years. In the final few years of wind farm operation, the Applicant will commence inspections and surveys of the bird nesting structure to determine if an extension of the lifetime is possible.

4.1.4.4 It is currently anticipated that both the predator eradication and bycatch measures implementation will result in new management practices which shall continue for the lifetime of Hornsea Four. Fish habitat enhancement (seagrass) compensation measure sites will be left in perpetuity.

4.1.5 Offshore Artificial Nesting Structure (New and Repurposed)

4.1.5.1 The provision of a new or repurposed artificial nesting site is presented as a potential Compensation Measure for the black-legged kittiwake (*Rissa trydactyla*) (referenced throughout as kittiwake).

4.1.5.2 Kittiwake have been observed readily (APEM 2021 and NIRAS 2021) utilising man-made structures. As such, the provision of an offshore artificial nest site to increase the annual recruitment of kittiwake into the regional population of the southern North Sea. Evidence supporting the measure is presented within the Applicant's ecological evidence reports (**B2.7.1 Compensation measures for FFC SPA: Offshore Artificial Nesting: Ecological Evidence (APP-187)**, **B2.7.3 Compensation measures for FFC SPA: Onshore Artificial Nesting: Ecological Evidence (APP-189)**). This is considered a potential primary Compensation Measure relating to in-combination collision effects during the operation and maintenance phase of Hornsea Four on the kittiwake population designated at the FFC SPA. The aim of the Compensation Measure is to provide one structure that can collectively sustain a breeding population of kittiwake, which would produce sufficient breeding adults to compensate for the estimated impact of Hornsea Four.

4.1.5.3 The Applicant is considering two options by which to achieve this:

- Repurposing an existing oil and gas platform (Wenlock platform) that is due for decommissioning (preferred option); or
- Construction of a new offshore nesting structure (within the Area of Highest Ecological Potential).

4.1.5.4 The Area of Search for offshore artificial nesting structure (both new and repurposed structure) is shown in **Figure 1** and set out within the **B2.7.2 Compensation measures for Flamborough and Filey Coast (FFC) Special Protection Area (SPA): Kittiwake Offshore Artificial Nesting Roadmap** (submitted at Deadline 7)**.** The site selection process for the offshore structure is outlined in the Derogation Case (specifically **B2.7.5 Compensation measures for FFC SPA: Artificial Nesting: Site Selection and Design (APP-191)**). The purpose of the site selection process has been to identify an area, or existing structure (e.g., an oil and gas platform), to host an artificial nesting structure that will be occupied by new recruits that will contribute to an increase of breeding adults to the relevant biogeographic population. The principles influencing optimal site selection include:

- Locations with connectivity to the relevant biogeographic population – based within the North Sea;
- Locations with proximity to reliable food resources – close to sea fronts (e.g. southern North Sea); and
- Locations with proximity to growing kittiwake colonies – near to known offshore sites with colonies of kittiwake (e.g., southern North Sea oil and gas platforms).

4.1.5.5 Ongoing consultation will involve conservation and ornithological groups with local knowledge and expertise. Updates on progress on the site selection are presented within the **B2.7.2 Compensation measures for Flamborough and Filey Coast (FFC) Special Protection Area (SPA): Kittiwake Offshore Artificial Nesting Roadmap** (submitted at Deadline 7)**.** Post-consent, a steering group named the Offshore Ornithology Engagement Group (OOEG) would be convened by the Applicant to consult on the implementation, reporting and any necessary adaptive management of the structure as determined by the Applicant. The OOEG will aim to incorporate relevant stakeholders and ultimately inform the Kittiwake Compensation Implementation and Monitoring Plan (KCIMP).

New offshore artificial nesting structure

4.1.5.6 For the purpose of the assessment, a maximum design scenario of a single new offshore artificial nesting structure is considered, to be installed on one of the following foundation types, noting that the requirement for new offshore structure, location, and the exact foundation type are yet to be determined:

- Monopile;
- Mono-suction bucket;
- Gravity based foundation;
- Piled jacket; or
- Suction bucket jacket.

4.1.5.7 The overall design of a topside nesting structure is flexible, as long as suitable narrow nesting ledges are present for the areas intended for kittiwake. A summary of the key features an offshore platform for nesting might include is provided below for kittiwake:

- 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
- May include a shelter and potentially CCTV to enable monitoring of the seabirds.

4.1.5.8 The new offshore artificial nesting structure will likely be installed in two stages, firstly the foundation will be installed, and secondly the topside will be lifted from a jack -up vessel (JUV) onto the foundation. Some form of seabed preparation (boulder and sandwave clearance), unexploded ordnance (UXO) clearance and scour protection may be required for the foundations.

4.1.5.9 The maximum design scenario parameters for a new offshore nesting structure is presented below in **Table 4**.

Table 4: Maximum design parameters for a new offshore nesting platform.

Parameter	Maximum design parameter
Number of offshore nesting platforms	1
Topside structure length (m)	25
Topside structure width (m)	25
Topside structure height (m above LAT)	20
Topside thickness (from topside to upper level of foundation) (m)	10
NOTE: Foundation dimensions are dependent on topside dimensions. Which in turn are dependent upon the design of the final topside, which is dependent upon the number of kittiwakes to be compensated.	

4.1.5.10 Full details regarding the potential development can be found in **A4.6.1: Compensation Project Description** (Deadline 7 submission).

Repurposed offshore artificial nesting structure

4.1.5.11 The Applicant could utilise a single existing offshore platform (potentially an existing oil and gas structure or similar), and use the foundation to either design, construct and install a new topside once the existing topside structure has been removed and decommissioned or repurpose the existing topside structure by adding additional nesting ledges.

4.1.5.12 The topside of the repurposed structure will be up to 19 m above LAT, up to 16 m long, and 13 m wide. The topside design will follow the same principles as outlined in **Table 4**.

4.1.5.13 Foundation installation is not required if repurposing an existing offshore platform. However minor modifications to the existing offshore platform foundation may be required. Foundation repurposing installation activities could include repairs, modifications, or reinforcement of existing foundation infrastructure. All modifications would be undertaken using either or a combination of Dynamic Positioning (DP) and JUV vessels.

4.1.6 New Onshore Artificial Nesting Structure

4.1.6.1 The Applicant is proposing an onshore artificial nesting structure for kittiwake if during Examination, the Secretary of State considers that an alternative (to a preferred repurposed or new offshore nesting) measure is required to the proposed primary measures outlined in **Section 4.1.5**. The approach to site selection and design are primarily driven by ecological/habitat requirements of the ornithology interests to increase the likelihood of colonisation and ensure the success of the structure. The onshore artificial nesting structure will be located within the Cayton Bay to Newbiggin by the Sea Area of Search (B1). The Area of Search for an onshore artificial nesting structure (either new or repurposed structure) is shown in **Figure 1**. Updates on the site selection for on onshore nesting structure have been provided in **B2.7.4 Compensation measures for FFC SPA: Kittiwake Onshore Artificial Nesting Roadmap** (submitted at Deadline 7) and in **G6.3 Kittiwake Onshore Artificial nesting Structure Site Selection and Evidence on Nesting Limitations update (REP6-031)**.

4.1.6.2 The structure will be designed to accommodate the level of compensation required for kittiwake and will accord with the design principles and indicative maximum parameters set out below.

4.1.6.3 The design principles for an onshore artificial nesting structure are subject to significant further development; however, design principles of direct relevance to the size or appearance of the structure are as follows:

- Steep sided with a near vertical back wall and narrow horizontal ledges.
- Located close to water, facing out to sea (i.e. nest adjacent to/above harbour waters/sea).
- Inaccessible to predators (additional anti-predation features may be required at some sites
  – e.g. fences/ barriers to deter mammalian predators (e.g. foxes and rats) and dependent
  on design bird spikes may be required as avian predator deterrents).
- Nesting ledges located above the level of highest astronomical tide and beyond the reach of wave or tidal action.
- Adequate ledge dimensions: Horizontal ledges 20 cm width; length per pair from 30 cm (working length 40 cm); and height between ledges at a minimum of 40 cm and maximum of 60cm. (Note these may be subject to change based on feedback from the stakeholders during detailed design).
- Minimum height at which the lowest shelves should begin depends whether the structure is located directly over water or set back slightly, as well as the level of human disturbance anticipated.
- Overhang/roof to buffer against weather conditions as to act as and additional predator deterrents.
- Vertical wall leaning slightly forward (working angle of 5°; to minimise lower ledges becoming fouled by droppings and reduce predation risk).

- Using materials which are in-keeping with the structure's surroundings whilst ensuring they meet the requirements of kittiwake's natural habitat as much as possible.
- Higher ledges could be wider than lower ledges (to prevent lower ledges becoming fouled by droppings) (BTO Field Guide No. 23, du Feu (2015)). However, wider upper ledges may increase predation risk/ allow non target species to nest.

Construction

4.1.6.4 The construction of the onshore artificial nesting structure depends on whether the structure comprises a building, or prefabricated structure (dependant on monitoring and access requirements for tagging). Building construction works, are anticipated to comprise:

- Site preparation works, including vegetation clearance (if required), erection of site fencing and small-scale enabling works;
- Establishment of a site compound and temporary site infrastructure, including a site cabin and welfare facilities;
- Delivery of construction materials and equipment;
- Installation of necessary foundations (to be confirmed, dependant on detailed design and site location); and
- Construction of the nesting structure on-site, methodology of which is dependent on the materials to be used (to be agreed as part of detailed design). Materials used for the building may comprise concrete, wood, or metal).

4.1.6.5 Prefabricated structure construction works are anticipated to comprise:

- Site preparation works, including vegetation clearance (if required), erection of site fencing and small-scale enabling works;
- Establishment of a site compound and temporary site infrastructure, including a site cabin and welfare facilities;
- Delivery of pre-fabricated components of the nesting structure and equipment;
- Installation of necessary foundations (to be confirmed, dependant on detailed design and site location); and
- Assembly and installation of the nesting structure on-site, methodology of which is dependent on the materials to be used (to be agreed as part of detailed design). Materials used for the pre-fabricated structure may comprise wood or metal.

4.1.6.6 Construction is anticipated to comprise a maximum of 10 Annual Average Daily Traffic (AADT) Heavy Goods Vehicle (HGV) movements (subject to detailed design). The site may require a temporary construction access track (dependant on site location), using crushed aggregate on geo-textile, soil stabilisation or temporary trackway. The access track will be 10 m wide, comprising 6m wide road (with 7 m wide passing places) and additional width for topsoil storage. The maximum depth of the access track would be 1 m.

4.1.6.7 A temporary logistics compound may be required and the dimensions of which would be approximately 70x70 m.

Operation

4.1.6.8 Once the construction of the onshore artificial nesting structure is complete, the site will be secured using fencing and the structure will be operational. Whilst operational activities are under development, **Table 5** outlines some design principles that may be of relevance, dependant on stakeholder input and detailed design consideration.

Table 5: Onshore nesting structure design principles.

Importance	Principle Description
Optimising monitoring	Capacity for remote monitoring devices e.g. cameras to be fitted to the structure. Ideally these would need to provide coverage of all available ledges at a sufficiently high resolution to monitor individual nests and their contents e.g., chicks and eggs, to be inspected.
Optimising monitoring / essential at some sites	Complex monitoring, to include: • Internal access; • Enclosed structure where the personnel monitoring within would be hidden from view, including to birds flying above and therefore minimising any disturbance; • Either with hatches to allow access from behind/within the structure to individual nests by suitably qualified ornithologists undertaking monitoring works; • And / or one-way glass to allow observations to be made from interior/back of structure; • Capacity for additional monitoring equipment to be accommodated within/on the structure (nice to have, not essential); and • Sanitation facilities (requirement to be determined).
Desirable (a, d) Optimising success (b, c, e)	Capacity for the structure to be modified to facilitate adaptive management design features after they have been operational for some time and if required. These may include: • Extension of structure to facilitate further nesting spaces. This would require either sufficient space to expand (laterally or vertically) or designed-in expansion points – for example a modular structure which can be extended; • Relocation of nesting structure. This would require straightforward assembly of components and potential to disassemble, balanced against longevity and stability of the structure; • Additional protection from elements e.g. wind/weather shield location points; • Enhanced predator deterrent e.g. straightforward roof and fencing maintenance, including opportunities to add avian predator deterrents; and • Provision of nesting material, such as seaweed. This would require additional protected space around or under the structure.

4.1.6.9 The number of monitoring visits is anticipated to be low, accessing the site on foot where possible. It is acknowledged that the location of the nesting structure is to be determined. Therefore, noise and odour levels are to be determined during detailed design phase once the proximity to local communities has been calculated. This is anticipated to be post-consent of Hornsea Four.

4.1.6.10 Monitoring and maintenance activities could theoretically comprise the following:

- Removal of kittiwake guano from structure and appropriate disposal;
- Remedial works to structure (i.e. storm damage to nesting ledges);
- Ensuring structure is structurally sound;
- Changing batteries used for speakers playing kittiwake calls; and
- Removal of litter, graffiti or any objects deemed hazardous to kittiwakes.

4.1.6.11 Further project description details in relation to new onshore artificial nesting structure can be found in **Volume A4, Annex 6.1: Compensation Project Description** (Deadline 7 submission).

4.1.7 Bycatch Reduction Technology

4.1.7.1 The implementation of bycatch reduction technology is presented as a potential Compensation Measure for guillemot and razorbill in relation to gillnet bycatch.

4.1.7.2 Bycatch, which is the incidental capture of non-target species in fisheries, can present a significant pressure on seabird populations (Miles et al. 2020). Within recent decades, seabird populations have plummeted, largely due to commercial fisheries (direct competition and bycatch) (Croxall et al. 2012). Monitoring of the issue is extremely low with onboard observer monitoring coverage relatively low compared to the number of fishing vessels (Pott and Wiedenfeld 2017). To mitigate against the number of seabirds, specifically razorbills and guillemots that may be at risk of displacement, the Applicant proposes to support the overall numbers of these birds through the reduction of bird bycatch in selected UK fisheries with connectivity to the populations from FFC SPA.

4.1.7.3 The reduction of bird bycatch will be achieved through the use of additional deterrent equipment attached onto fishing gear. Different bycatch reduction techniques are more suited to specific fishing gear types and specific target bycatch species of birds. The proposed bycatch reduction methods being considered as a package of compensation measures are above water deterrents (AWDs), net lights, and net panels.

4.1.7.4 Potential fisheries with reported bird bycatch and population connectivity with the FFC SPA include the South coast of England and the Thames Estuary. The south coast was included within the Applicant's bycatch reduction trails (presented within the Applicant's **G5.13 Bycatch Reduction Technology Selection Phase Summary report (REP5-068)**). The South coast of England will also be considered in future data collection and future implementation. Specifically, bycatch hotspots have been identified in both the South East and South West of the UK, along with reports of bird bycatch at other locations along the south coast and in the Thames Estuary. The AoS for bycatch reduction technology is shown in **Figure 1**; these depict areas where fishing takes place and where bycatch reduction trials may be targeted.

Fishery selection

4.1.7.5 Current research suggests that gillnetting, depending on location and seasonality, suffers high levels of bird bycatch (Northridge et al. 2020). As such, many of the bycatch reduction types currently available are focussed on bycatch from gillnets. This Compensation Measure will therefore include bycatch reduction of bird bycatch from gillnet fisheries. There is less evidence to support the contribution of other fishing methods on bycatch, including mid-water trawl bycatch. Evidence gathering by the Applicant is ongoing for mid-water trawl bycatch, however, there is not currently enough evidence to demonstrate the efficacy of above water deterrents as bycatch reduction for mid-water trawls at the moment.

4.1.7.6 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, it is likely that bycatch rates will also vary as higher seabird densities increase the bycatch risk (Bradbury et al., 2017). It is therefore important to evaluate temporal variations when identifying areas of high bycatch vulnerability for the purpose of planning bycatch reduction measure locations.

4.1.7.7 Potential fisheries with reported bird bycatch and population connectivity with the wider site network and include the UK South coast, Cornwall, and the Thames Estuary. All of these locations are included within the Applicant's potential bycatch reduction trails (see **G5.13 Bycatch Reduction Technology Selection Phase Summary (G5.13)**). Bycatch hotspots have been identified in both the South East and South West of the UK, along with reports of bird bycatch at other locations along the south coast and in the Thames Estuary.

Above Water Deterrents

4.1.7.8 AWDs are typically structure fixed to buoys or markers attached to set fishing gear, which work to scare birds away from fishing nets. Current nets are often made from monofilament nylon, which is nearly invisible to seabirds underwater and so the aim of deterrents is to deter birds from approaching the nets and becoming entangled. Specifically, the proposed AWD is a Looming Eyes Buoy (LEB), which is comprised of a floating buoy, topped by a long stick and a marker on the top that includes an eye-like pattern (**Figure 2**). The aim of the buoy is to work like a scarecrow in scaring birds away from nets. The eye design on the top panel may mimic deterrent eye patterns found in nature, whilst the bobbing and spinning of the buoy will result in a "looming" effect over the birds, thus deterring them from approaching the buoys. They are not designed to make any noise or light and are attached to the fishing equipment already in place. LEB formed the basis of the Applicant's bycatch reduction trial (preliminary first year result provided within the Applicant's **G5.13 Bycatch Reduction Technology Selection Phase Summary report (REP5-068)**).

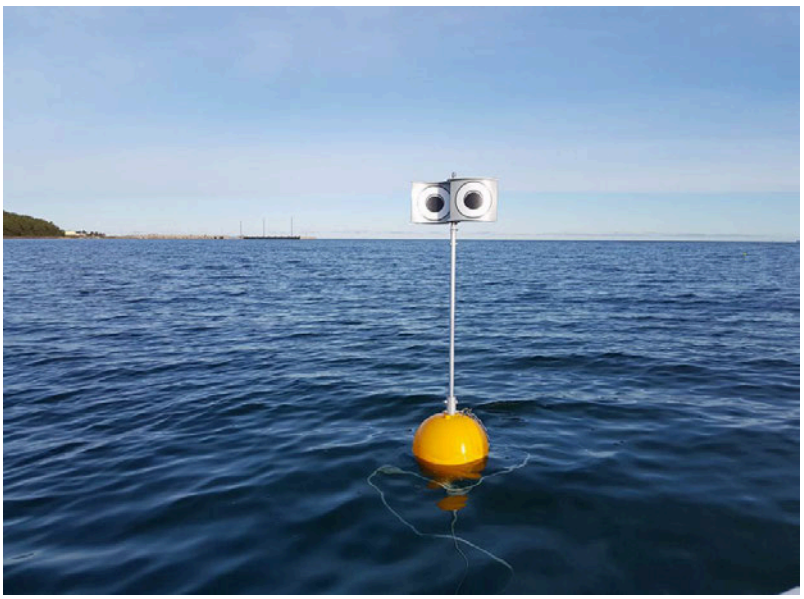


Figure 2: Looming Eyes Buoy (Source: The Independent[4]).

[4] [redacted]

Net lighting (Light Emitting Diodes [LEDs])

4.1.7.9 LED net lights are small simple lights which can be attached to existing fishing gear to act as a deterrent to non-target species. The aim of the lights is to increase the visibility of the nets in the water to birds and marine mammals so that they do not become entangled with the nets. There are multiple designs available of these lights, with the majority being pre-attached to the nets ahead of deployment and remaining in place until the nets are hauled in. No additional vessel presence and/or movement or equipment is required. This method has not been selected by the Applicant at this stage but may form part of the measure's adaptive management.

Figure 3: A commercially available net light (Source: Fishtek[5])

Net panels

4.1.7.10 Attaching highly visible panels to nets may increase the visibility of the nets to diving birds and therefore reduce bycatch. Panels may comprise equally spaced black and white squares, attached to the surface of nets, to ensure they are highly visible to diving birds. The panels often require holes in them to reduce the effect of currents on the set gear. The panels are pre-attached to nets and are deployed as the nets are set. No additional vessel presence and/or movement or equipment is required. This method has not been selected by the Applicant at this stage but may form part of the measure's adaptive management.

Implementation, operation and monitoring

4.1.7.11 The bycatch reduction technology selection and implementation study phases for Looming Eye Buoys commenced in October 2021. In order to determine the most effective bycatch reduction method, the Applicant commenced a bycatch reduction technology selection phase in 2021, focusing on the use of Looming Eyes Buoys (LEB) within an active gillnet fishery within the biogeographic range of guillemot and razorbill. LEB were selected as they are one of the most developed forms of above water deterrent, which have been developed and trialled by BirdLife International/ RSPB in conjunction with Fishtek Marine (i.e. Rouxel et al., 2021). The preliminary findings from the bycatch reduction technology selection phase using the LEB are promising, with an initial 25% reduction in bycatch of auks identified. (**G5.13 Bycatch Reduction Technology Selection Phase Summary (REP5-068)**). The results of the bycatch reduction technology selection phase are similar to the results from Rouxel et al., 2021 who provided the first experimental test of the LEB (noting the differences in study species). The Applicant has

[5] [redacted]

committed to use the LEB on vessels during the non-breeding season 2022/2023 and collect further data from September 2022 to March 2023.

4.1.7.12 Implementation of the planned compensation will begin following determination of the DCO application by the Secretary of State. Details on the proposed implementation of the measure are provided within the Applicant's **B2.8.2 Compensation measures for Flamborough and Filey Coast (FFC) Special Protection Area (SPA): Guillemot and Razorbill Bycatch Reduction: Roadmap** (submitted at Deadline 7). The Wind Farm is expected to operate for 35 years following construction. If required, the accepted bycatch reduction measure(s) would be used and monitored throughout the operational lifespan of the Wind Farm. Following the monitoring programme, overall measure uptake and success of the bycatch reduction measure, the equipment may continue to be used as a deterrent.

4.1.8 Predator Eradication

4.1.8.1 To compensate the potential displacement impact on guillemot and razorbill from the operation of the Hornsea Four Wind Farm, The Applicant proposes to implement a predator eradication programme at selected guillemot and/ or razorbill breeding colonies. The selected colony will be chosen based on delivery and connectivity to the populations from FFC SPA. This would be part of a package of compensation measures for these species.

4.1.8.2 Predator eradication will be undertaken using well established methods evidenced throughout the wealth of previous predator eradication examples from the UK and further afield. For ground predators, such as rats, this usually involves poison bait stations. The primary species the measures of predator eradication would be focussed upon are rat and house mouse but could extend to include mink or crow as a supportive measure pending ecological advice and stakeholder discussions, whilst ensuring non-targeted species are not accidently eradicated.

4.1.8.3 Following the removal of the invasive species, biosecurity measures will subsequently be installed to prevent re-invasion. Biosecurity measures form a vital consideration in ensuring that efforts to remove invasive species have not been undertaken in vain. There are a significant number of biosecurity measures available depending on the location and species being considered, all of which have been tried and tested at previous predator eradication schemes (i.e. Biosecurity for LIFE project).

Location

4.1.8.4 It is proposed that predator eradication will be undertaken on an island or islands where both invasive mammalian predators and guillemot and/or razorbill are present. The Applicant is currently liaising with site managers at multiple islands to understand the prevalence of invasive mammalian species and ascertain the level of pressure posed to breeding guillemot and razorbill. The Bailiwick of Guernsey, within the Channel Islands, is currently being considered for predator eradication.

4.1.8.5 Before any predator eradication schemes are implemented at a specific location, an eradication implementation study will be undertaken to ensure measures can be employed to remove the invasive species and that biosecurity measures can be subsequently installed to prevent reinvasion, whilst not affecting the native species and/or species that may not affect guillemot and/or razorbills. The island implementation studies were initiated in 2021 by the Applicant in the Bailiwick of Guernsey to gather further evidence to maximise the chances of success of the eradication programme and feed into the decision-making process of which island(s)/islet(s) to take forward. It is planned that the implementation studies will be completed in 2022 before the DCO is granted. An update of the progress up to June 2022 is presented within **G5.4: Predator Eradication Implementation Study Update (REP5-082)**. An MoU has been agreed by the States of Guernsey (dated 10th June 2022) providing a framework to ensure support and long term security of the compensation measure. Based on the evidence collected during the eradication implementation studies and presented within **G5.4: Predator Eradication Implementation Study Update (REP5-082)**, the Applicant is highly confident it has determined locations where eradication is highly feasible, deliverable and will result in benefits to guillemot and razorbill.

Operation, implementation, and monitoring

4.1.8.6 The objective of the eradication programme will be to remove mammalian predators from the island(s) that are currently suppressing the breeding success (and therefore, population size) of guillemot and razorbill (amongst other species) at these locations. The removal of this pressure will therefore lead to an increase in productivity and ultimately an increase in the population size of these species, whilst not affecting any other species that are not known to be detrimental to guillemot and/or razorbills.

4.1.8.7 Following the implementation studies and in partnership with site managers, invasive species eradication specialists will be contracted to undertake the island(s) eradication. Consideration of the timing of a predator eradication programme will be made to ensure that they are undertaken at the optimal time and that will not for example affect a species/habitat that are not known to be detrimental to guillemot and/or razorbills.

4.1.8.8 The primary aim of an eradication scheme is always to completely remove the introduced animal from the chosen area. Two years intensive monitoring for the presence of the eradicated animal is required to receive the invasive-free status (Nathan et al., 2015; Russell et al., 2017). For example, this was the process taken for the eradication of rats on Canna and Sanday under contract by Wildlife Management International, starting in late 2005. By February 2006 the last rat sign was detected, and after a two-year period of intensive monitoring, the island was declared rat-free in 2008 (see Bell, et al., 2011). The predator eradication programme would only be undertaken by appropriate qualified people and all methods will be agreed with the appropriate stakeholders.

4.1.8.9 Following the invasive species free status, seabird recovery monitoring will continue for the lifetime of Hornsea Four. Monitoring will include population census and productivity monitoring. This will be compared to pre-eradication data (which will be collected to characterise the baseline and supplement historic seabird data for the location where available). The presence of invasive species will also be monitored to detect signs of repopulation.

Summary of Predator Eradication Compensation Measure

4.1.8.10 Predator eradication is a primary Compensation Measure. In-combination with other primary razorbill and guillemot measures, predator eradication will be able to deliver the required level of compensation for Hornsea Four. A detailed evidence report, and roadmap has been submitted with the DCO application to demonstrate the potential compensation deliverable by the predator eradication programme both alone and combined with the other primary compensation measures. The evidence report includes a summary of the supporting evidence for predator eradication compensation and the roadmap outlines the further steps that will be undertaken from submission to demonstrate that the Compensation Measure can be secured. These Compensation Measures are effective, feasible and securable measures that can be implemented prior to the impact occurring and sustainable for the lifetime of the project. In designing this compensation measure the Applicant has consulted and worked with Natural England, JNCC, the RSPB, The Wildlife Trust, other statutory bodies and other relevant stakeholders to seek to ensure this compensation measure is both robust, deliverable and effective.

4.1.9 Resilience Measure – Fish Habitat Enhancement (Seagrass)

4.1.9.1 Fish habitat enhancement (as a concept) seeks to improve vital habitats for fish species such as those that provide spawning or nursery grounds, with an aim of increasing the productivity of fish populations. This in turn will increase prey abundance for many seabird species (e.g. kittiwakes, guillemots) who are known to forage in coastal shallow water areas when nesting (Bugge et al. 2011; Redfern and Bevan 2014) and consume young fish known to be abundant in seagrass (Bugge et al. 2011; Lilley and Unsworth 2014). Therefore, the restoration of seagrass habitats is being considered as a potential Resilience Measure to boost key forage fish densities for kittiwake, guillemot and razorbill breeding adults to compensate for the estimated impact of Hornsea Four.

4.1.9.2 The Applicant recognises the importance of seagrass as a measure that can provide resilience to the compensation measures such as predator eradication, habitat management, bycatch reduction and provision of artificial nesting. The Applicant proposes to provide a package of measures that will support the seabird populations such as kittiwake, guillemot and razorbill locally and in the North Sea. The measures will be designed to seek opportunities to be spatially co-located to maximise the benefits of the measures and located to ensure the overall coherence of the network is maintained. 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 improve the resilience of the measure.

4.1.9.3 The site selection process for these seagrass locations is outlined in the Without Prejudice Derogation Case (specifically **B2.8.5 Compensation measures for FFC SPA: Fish Habitat Enhancement: Ecological Evidence (APP-198)**. The purpose of the site selection process has been to identify areas supporting all the target seabird species and are suitable for seagrass restoration projects. The resulting AoS is shown in **Figure 1**, the Humber Estuary, with this area consistently supporting all of the target seabird species, providing options for seagrass restoration as well as supporting the compensation measures. This location (Humber Estuary) has been taken forward for trials and has been determined through the implementation study as the highest scoring future implementation. Furthermore, **G6.6 Fish Enhancement Seagrass Restoration Implementation Study and Fish Monitoring Summary (REP6-033)** presents an update on the ongoing monitoring work and research studies in relation to this measure and an overview of the anticipated next steps.

4.1.9.4 Consultation will commence with conservation and ornithological groups with local knowledge and expertise. The detail of the continued site selection process and consultation is presented within **B2.9: Record of Consultation (APP-201)**.

Seagrass restoration trials

4.1.9.5 Prior to obtaining consent of Hornsea Four, the Applicant has explored suitable locations and selected the area deemed most suitable for seagrass restoration to provide resilience for the Hornsea Four compensation measures. The refined area for seagrass restoration is Spurn Point in the Humber Estuary and the Applicant has commenced seagrass restoration efforts with a trial scheme. In total the Applicant has contracted the Yorkshire Wildlife Trust (YWT) to restore 4 ha of seagrass beds and has an agreement in place to deliver the full large-scale restoration of a further 30 ha following SoS decision. The Applicant has also undertaken a UK site implementation study for proposed adaptive management measures.

4.1.9.6 The area within which the trial planting is taking place is Spurn Point, this location was selected by the YWT and the Applicant being adjacent to remnant seagrass beds and as YWT own the foreshore and have a byelaw in place to protect the area. Further studies of the seagrass restoration scheme are being conducted by the YWT and the UoH, these aim to monitor the success of the restoration effort, effects on fish assemblages and abundance and demonstrate fish connectivity to wider North Sea.

Restoration techniques

4.1.9.7 The Applicant is considering two major techniques by which to restore seagrass habitats: replanting and reseeding.

4.1.9.8 Seagrass restoration has been formally conducted for over 50 years and the means of doing this can principally be split into two major techniques: reseeding and replanting. Both techniques have their relative merits and have exhibited varying levels of success. Reseeding generally relates to the collection and targeted redistribution (and sometimes processing) of wild seed. Seeds can be directly deployed either from the boat or for intertidal areas, deposited using tree planting tool (pottiputki), and often hessian bags are used to help anchor the seeds in place during germination. It is expected that if vessels are required, then up to two vessels would be required for the seagrass restoration.

4.1.9.9 Adult shoot replanting normally involves harvesting plants from an existing meadow and transplanting them to the restoration site. For the replanting process, the reproductive fronds of wild seed is collected by hand by SCUBA divers or by collection on foot from the foreshore. 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 for subtidal areas or by personnel using a manual hand tool (dibber and seed press) on foot for intertidal areas.

Monitoring and Adaptive Management

4.1.9.10 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 the Hornsea Four. The exact method of monitoring will be decided based upon further evidence gathering and discussion with restoration experts and stakeholders. A monitoring programme will be developed and at key stages the results of the restoration will be shared to improve the knowledge and evidence for seagrass restoration.

4.1.9.11 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 will be an important component of the compensation measure and will be used as a method to address unforeseen issues or deviations from expected time scales (i.e. additional infill planting required).

4.1.9.12 It is assumed that any onshore access to the area chosen for seagrass restoration will be through existing highways and/or footpaths. It is considered that no new access roads will be required and that no construction is required as part of the measure. Any requirement for vehicle movements during site suitability surveys, the restoration process or subsequent monitoring are considered to be negligible. Therefore, onshore impacts have been scoped out of the assessment.

5 Consultation

5.1.1.1 The Applicant has undertaken extensive consultation with relevant stakeholders as part of the preparation of the Without Prejudice Derogation Case (namely, Natural England, Joint Nature Conservation Committee (JNCC), the Royal Society for the Protection of Birds (RSPB), the Marine Management Organisation (MMO), PINS, Defra, Local Planning Authorities, The Wildlife Trusts, the National Federation of Fisherman's Organisations (NFFO) and relevant local organisations with key knowledge) regarding compensation for Hornsea Four. Relevant stakeholders will be engaged through the Hornsea Four Offshore Ornithology Engagement Group (OOEG). Further detail on this consultation is presented in the Record of Consultation (**B2.9: Record of Consultation (APP-201)**). Consultation will be ongoing with various stakeholders for all proposed compensation measures at various stages through the process.

5.1.1.2 The Applicant has undertaken further consultation specifically in relation to the Compensation Measures with statutory consultees who may have an interest in the proposed Compensation Measures, and certain stakeholders located in the vicinity of the land potentially affected by the measures. This targeted consultation ran from 5th August to present. All responses and comments are presented in **B1.1.37 Non-Statutory Targeted Compensation Measures Consultation Responses (APP-166)** alongside the regard the Applicant has had to these consultation responses.

6 EIA Methodology

6.1 Introduction

6.1.1.1 **A1.5: Environmental Impact Assessment Methodology (APP-011)** of the Hornsea Four ES sets out the EIA methodology followed for Hornsea Four. Specifically, the chapter describes the approach used to identify, evaluate and mitigate potential likely significant effects (LSE), in EIA terms, using a defined proportionate approach to the assessment process. The requirement for EIA and the proposed temporal, spatial and technical scope of the assessments are described along with details of the Applicant's specific 'commit – design – consult' ethos to developing Hornsea Four. This detail is equally relevant to the Compensation Measures EIA and as such, most of this detail is not repeated within this Annex. To enhance the readability of this Compensation Measures EIA, some elements of EIA methodology are repeated below to allow this document to be read and understood without extensive cross-referencing to other documents required.

6.1.1.2 It is important to note that given the broad nature of the proposed Compensation Measures and the extensive refinement of the site selection process that will be undertaken as part of their own consenting process (for example a Marine Licence application and/or Planning Application), the assessment presented within this Annex broadly follows the approach set out in **A1.5: Environmental Impact Assessment Methodology (APP-011)** of the Hornsea Four ES in terms of the stages followed (i.e. characterisation of the existing environment, identification of receptors, assessment, and commitments). More specifically, the stages followed in this Annex are summarised in the following sections. Where elements of the approach outlined in this Annex vary from that which is outlined in **A1.5: Environmental Impact Assessment Methodology (APP-011)**, this is noted in the sections below with justification for the approach provided.

6.2 Overview of Process

6.2.1.1 EIA is a systematic, iterative and prescribed process framed by statutory requirements as well as the relevant planning and policy context (see **A1.2: Planning and Policy Context (APP-008)**). Furthermore, consideration of best, good and advised EIA practice and adoption of a Proportionate EIA approach (see **A1.5: Environmental Impact Assessment Methodology (APP-011)**) has guided the specific approach followed by the Applicant in relation to this Compensation Measures EIA.

6.2.1.2 The key elements of the Compensation Measures EIA process and the identification of significant effects are described in the following sections. While these provide a general framework for identifying impacts and assessing the significance of their effect(s), in practice the approaches and criteria applied across different EIA topics vary.

6.2.1.3 An overview of the approach to the Compensation Measures EIA is provided in Figure 4.

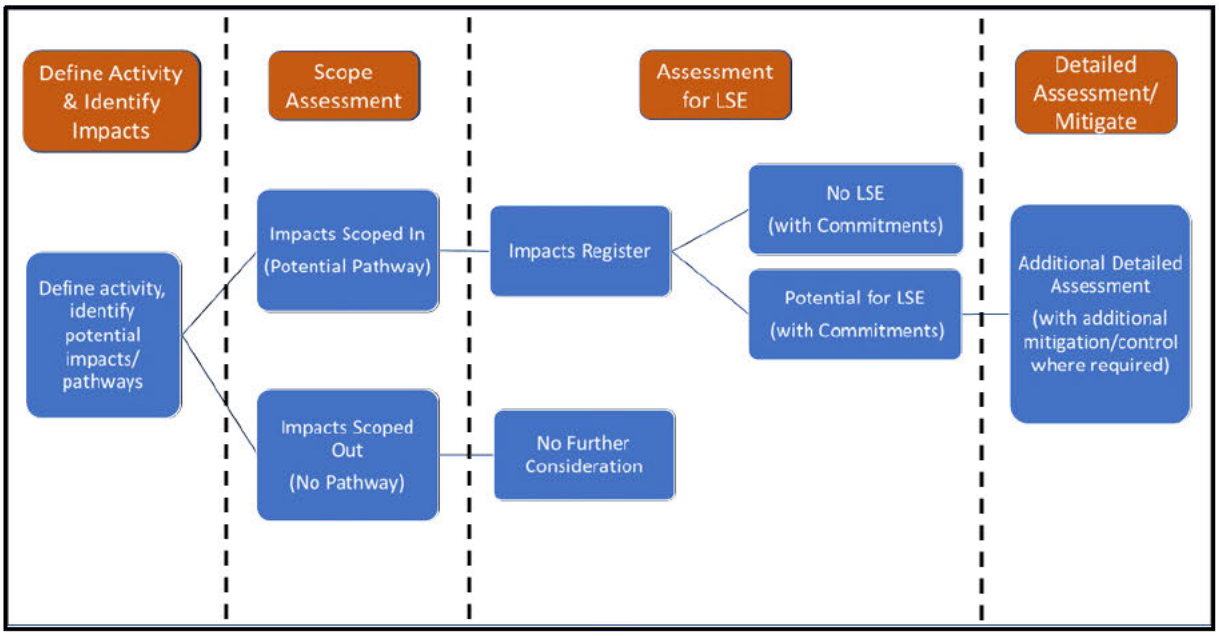


Figure 4: Compensation Measures EIA Process.

6.2.2 Maximum Design Scenario (MDS)

6.2.2.1 The MDS parameters for the relevant Compensation Measures are considered to be a worst case for any given assessment. This approach ensures that the scenario that would have the greatest impact (e.g. largest footprint, longest exposure, or tallest dimensions, depending on the topic) is assessed; and there is confidence that any other (lesser) scenarios will have an impact that is no greater than that assessed.

6.2.2.2 Impact-specific MDS relevant to this Compensation Measures EIA, as they apply to each receptor group, are defined within A4.6.3: Compensation Impacts Register (Deadline 7 submission) for each Compensation Measure. For clarity regarding the differences between receptor groups, the information is presented according to individual project parameters, including a note regarding why the scenario is relevant to that receptor. Where relevant, the information includes any designed-in features which, whilst also providing mitigation, are integral to the design or physical characteristics of the project.

6.3 Compensation Impacts Register

6.3.1.1 A cornerstone of the Hornsea Four approach to delivering both proportionate EIA and delivery of commitments, is the development of an Impacts Register and this process has been followed for the Compensation Measures EIA. The Compensation Measures Impacts Register (A4.6.3: Compensation Impacts Register (Deadline 7 submission)) provides the following discrete and separate functions:

- Details all potential impacts associated with each Compensation Measure and provides a unique identification reference which can be traced through the subsequent steps/documents;
- Sets the scope of the Compensation Measures EIA with appropriate justification;

- States the magnitude, sensitivity and significance for all potential impacts associated with all activities, in all phases of development of each Compensation Measure;
- Identifies Commitments to reduce or eliminate LSE; and,
- Defines the Maximum Design Scenario (MDS) for any given impact.

6.3.1.2 The Compensation Measures Impacts Register (**A4.6.3: Compensation Impacts Register** (Deadline 7 submission)) is an Excel spreadsheet which identifies the potential impacts (and the resultant effects) that could possibly result from the installation/construction, implementation/O&M, and/or decommissioning phases of each Compensation Measure, relating to each technical topic under consideration in the EIA process. The register allows the user to sort and filter the impacts that are most relevant to them. The measures described within the impacts register that result in a potential for LSE have been considered for assessment within this EIA and are presented within the relevant sections.

6.4 Compensation Measures Commitments

6.4.1.1 All Commitments relevant to the Compensation Measures EIA are detailed in **A4.6.4: Compensation Commitments Register** (Deadline 7 submission) . As advocated in EIA guidance (e.g. IEMA 2004), it is only necessary to assess potential effects arising from the final design, incorporating all primary and tertiary mitigation (only pre-mitigation effects and residual effects need both be set out where secondary mitigation is required). In this respect, the Applicant has considered the Commitments in making an initial assessment of the likely significant effects.

6.5 Characterisation of the Existing Environment (Baseline)

6.5.1.1 As noted in **Section 4.1.2**, AoS have been identified for each Compensation Measure. These AoS range from small areas around islands or discrete sections of coastline, to larger areas spanning large areas of sea and coastlines. As these AoS can cover extensive areas, a high-level characterisation of the existing environment for each AoS has been undertaken to determine the baseline conditions in each AoS and relevant surrounding areas. The scope of baseline characterisation has been made relevant to the scope of the EIA in that if a specific EIA topic has been scoped out of the assessment in relation to a particular Compensation Measure, then the baseline for that particular topic is not presented. The baseline characterisation includes usage of readily available information from desktop study. It is important to note that the Compensation Measures will not be consented through the Hornsea Four DCO application process and where applicable will be subject to standalone EIA and HRA processes as part of their own consenting process (for example a Marine Licence application and/or Planning Application). As part of that consenting process, further baseline and assessment work will be undertaken, based on refined design and methodology details.

6.6 Impacts, Effects Mitigation and Significance

6.6.1.1 'Impacts' are defined as the physical (or chemical) changes that will be caused by Hornsea Four activities. 'Effects' are defined as the consequences of these impacts to biological populations, ecosystems and humans (including their physical and cultural assets).

6.6.1.2 For many technical topics, the likely significance of an effect is established by combining the magnitude of an impact with the sensitivity of the receptor to that impact (noting that sensitivity is not considered as an inherent characteristic but how something specifically responds to an external factor). The value of a resource or receptor is also considered. For more information on the methodology for assessing the likely significance of effects, including the significance matrix utilised in this assessment, see **A1.5: Environmental Impact Assessment Methodology (APP-011)**.

6.7 Cumulative, Inter-Relationships and Transboundary Effects

6.7.1.1 For consideration of cumulative aspects, it is assumed that where potential for LSE applies to the project alone, that potential for LSE applies cumulatively with other plans or projects. However, until the precise locations of any of the Compensation Measures are finalised, it is not possible to identify relevant plans and projects to include within a cumulative assessment cannot be made.

6.7.1.2 In addition, given the nature of the proposed Compensation Measures and the extensive refinement of the site selection process that will be undertaken, the consideration of inter-relationships and transboundary effects cannot be made at this stage.

6.7.1.3 It should be noted, however, that ultimately, the Compensation Measures will not be consented through the Hornsea Four DCO application process and so far as applicable, will be subject to standalone EIA and HRA processes as part of their own consenting process (for example a Marine Licence application and/or Planning Application). As part of that consenting process, further assessment work will be undertaken, including consideration of cumulative effects, inter-relationships and transboundary effects, based on refined design and methodology details.

7 EIA – New Offshore Artificial Nesting Structure

7.1 Introduction

7.1.1.1 This section considers the potential impacts arising from the new offshore artificial nesting structure Compensation Measure. An environmental characterisation of the physical, biological and human environmental baseline is presented alongside the results of an assessment of potential significant effects arising from the proposed Compensation Measure. Only one AoS has been identified for the new offshore artificial nesting structure Compensation Measure (A1: Southern North Sea) and as such, the baseline and assessment within this section relates to this AoS alone.

7.2 Baseline

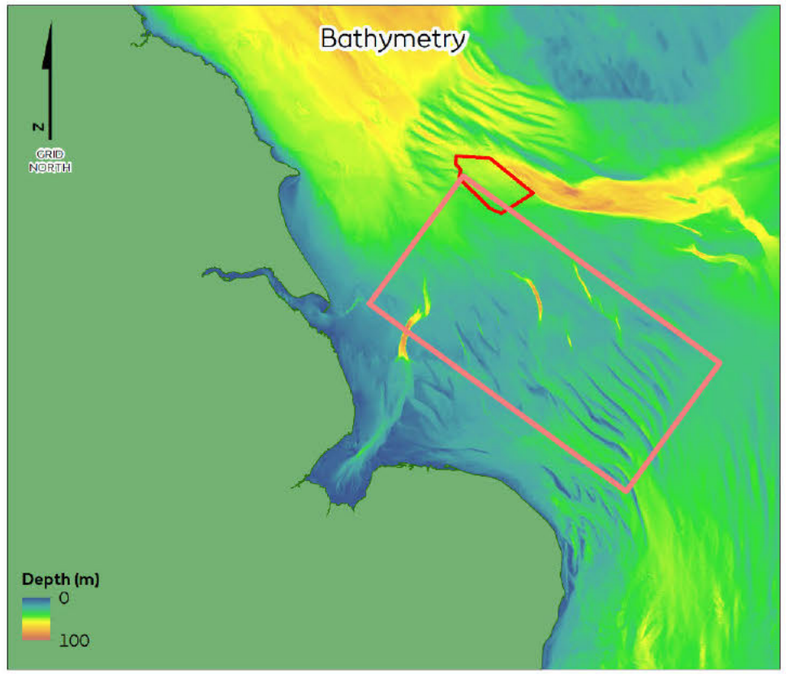
7.2.1.1 **Table 6** provides a summary of the baseline environment for AoS A1 (Southern North Sea).

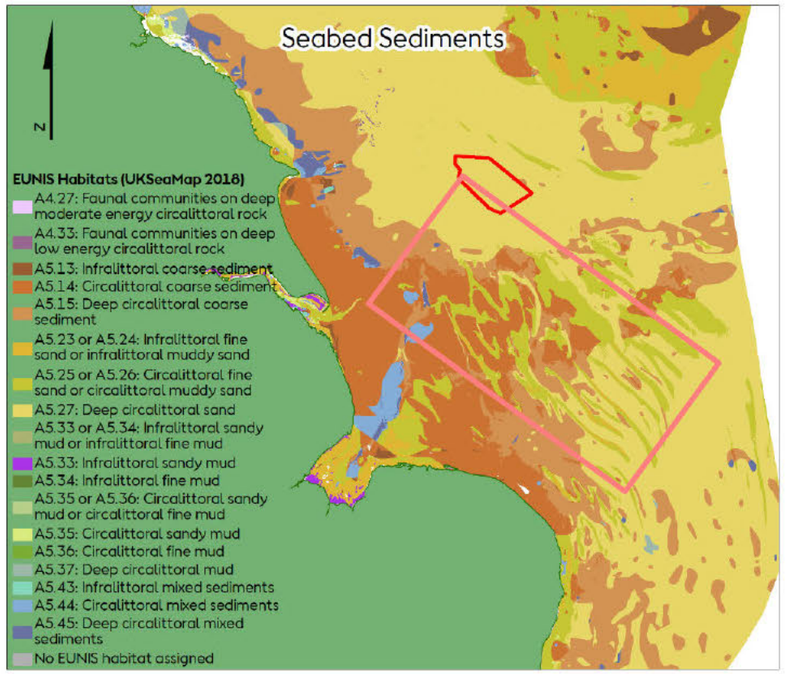
Table 6: Summary of baseline environment in relation to the Area of Search (Southern North Sea) for new and repurposed offshore nesting structure.

Topic	Summary of Baseline Environment
Marine Geology, Oceanography and Physical Processes	The baseline environment for marine geology, oceanography and physical processes is illustrated in Figure 5 and can be summarised in terms of: • Bathymetry: The A1 Area of Search covers a large area of the southern North Sea, a large, shallow continental platform that has experienced successive emergences and flooding during the Quaternary regression and transgression. The area is generally shallow and the south of the area is dominated by sandwave features off the Lincolnshire and East Anglian coast. • Geology and seabed sediments: The sedimentary environment consists of a mixture of sands, muds and gravels but is dominated by coarse sediments. In shallow waters, in particular in areas where there are sandwaves, the sediments tend to be coarser, whilst greater levels of fine sediments are found in deeper areas. • Hydrographic and metocean conditions: The southern North Sea is associated with distinct hydrographic conditions including shallow, well-mixed waters. The waters of the southern North Sea are slow moving with a southerly drift; they occasionally stratify and have considerable freshwater input from the River Humber. Spring tidal flows peak off the East Anglia coast and in The Wash closer to shore, decreasing with distance from shore. A similar pattern is observed for wave heights.
Benthic and Intertidal Ecology	The baseline environment for benthic and intertidal ecology is illustrated in Figure 6 and can be summarised in terms of: • Seabed habitats: The AoS contains a variety of benthic habitats across the southern North Sea, consisting of sands and mixed sediments with varying proportions of muds and gravels. • Species: the region is inhabited by various benthic infauna and epifauna, including polychaetes, bivalves, echinoderms, crustaceans and amphipods. • Designations: A number of designated SACs and MCZs for seabed habitats and benthic species are present across the AoS, including the North Norfolk Sandbanks and Saturn Reef SAC, the Holderness Offshore MCZ, and the Haisborough, Hammond and Winterton SAC.
Fish and Shellfish Ecology	The baseline environment for fish and shellfish ecology is illustrated in Figure 7 and can be summarised in terms of: • Species: A variety of fish and shellfish species are present in the southern North Sea region within the AoS, including commercially important species like plaice (*Pleuronectes platessa*), sole (*Solea solea*), dab (*Limanda limanda*) and whiting (*Merlangius merlangus*), as well as smaller non-commercially important species like weaver (*Tranchinidae*), gurnard (*Chelidonichthys cuculus*) and solenette (*Buglossidium luteum*). Shellfish species include the edible crab (*Cancer pagurus*), velvet swimming crab (*Necora puber*), brown and pink shrimp (*Pandalus borealis* and *Crangon crangon*), lobster (*Homarus gammarus*) and *Nephrops*. • Spawning and nursery habitats: The Area of Search overlaps with spawning and nursery areas for several species including herring (*Clupea harrengus*), sandeel (*Ammodytidae*), and edible crab. An important area for herring spawning is located just off Flamborough Head. Most of the commercially important species in the AoS spawn in the spring, between January and June, with the exception of the demersal spawning herring and sandeel.
Marine Mammals	The baseline environment for marine mammals is illustrated in Figure 8 and can be summarised in terms of: • Species: Several marine mammal species have been observed in the southern North Sea, including harbour porpoise (*Phocoena phocoena*), white beaked dolphin (*Lagenorhynchus albirostris*), minke whale (*Balaenoptera acutorostrata*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*). A population of bottlenose dolphin from the Moray Firth also extends down into the southern North Sea. • Designated sites: The Southern North Sea SAC is an area of importance for harbour porpoise, an Annex II species. This site includes key winter and summer habitat for this species and covers an area of 36,951 m^2, making it the largest SAC in the UK and European waters at the point of designation in 2019.

Topic	Summary of Baseline Environment
Offshore and Intertidal Ornithology	The baseline environment for offshore ornithology is illustrated in **Figure 9** and can be summarised in terms of: • Species: At least 19 species of seabird breed on the coasts of the Greater North Sea, in particular large numbers of northern gannet (*Morus bassanus*), herring gull *(Larus argentatus*), lesser black-backed gull (*Larus fuscus*), black-legged kittiwake (*Rissa tridactyla*), common guillemot (*Uria aalge*), razorbill (*Alca torda*) and puffin (*Fratercula arctica*). Kittiwake have a mean-max foraging range of 156.1 km and are concentrated around Flamborough Head in the north-west of the AoS. Guillemot and razorbill are also concentrated in the north-east of the AoS and have mean-max foraging ranges of 73.1 km and 88.7 km, respectively. • Designated sites: The key ornithological designated site in the vicinity of the AoS is the Flamborough and Filey Coast SPA, designated for a variety of breeding seabird colonies. The AoS is also in the vicinity of the Greater Wash SPA. • Surveys of oil and gas platforms in the offshore Area of Search (A1) were undertaken in 2021 and 2022 which found many platforms with kittiwake colonies and in addition breeding razorbill and guillemot have also been found during the 2022 survey. One platform recorded 499 kittiwake Apparently Occupied Nests during the 2022 survey. Further information on the colonies surveyed are illustrated in **Figure 3** of **B2.7.2 Compensation measures for Flamborough and Filey Coast (FFC) Special Protection Area (SPA): Kittiwake Offshore Artificial Nesting Roadmap (REP5-018)**.
Commercial Fisheries	The baseline environment for commercial fisheries is illustrated in **Figure 10** and can be summarised in terms of: • Fishing activity: Approximately 6,600 fishing vessels operate in the Greater North Sea, with the largest numbers coming from the UK, Norway, Denmark, the Netherlands and France. Total landings have been decreasing since the early 1970s. • Fishing methods: The primary fishing methods used in the southern North Sea specifically are otter and beam trawls for demersal fisheries, and pelagic trawls and seines for pelagic fisheries, along with potting for crustacea including brown crab, lobster and whelk, and dredging for scallop. Within the AoS, beam trawling is concentrated in the south east, with very limited dredging and otter trawling. Potting is the most common fishing methods in the AoS and is focused off the Lincolnshire coast and outside the Humber Estuary.
Shipping and Navigation	The baseline environment for shipping and navigation is illustrated in **Figure 11** and can be summarised in terms of: • Vessel density: The southern North Sea is a busy area in terms of vessel traffic with regular transit between major European ports. Much of the traffic is coastal, in particular between the Humber across the coast of East Anglia to and from the English Channel. Clusters of traffic are also seen around offshore wind farms and oil and gas platforms within the AoS.
Aviation and Radar	The baseline environment for aviation and radar is illustrated in **Figure 12** and can be summarised in terms of: • Airspace: This AoS is in an area of Class G uncontrolled airspace, which is established from the surface up to Flight Level (FL) 195 (approximately 19,500 ft). • Radar stations: A number of civilian and military radar stations are located along the east coast of the UK looking out into the southern North Sea, including the MoD remote radar head locations are Staxton Wold and Trimingham. • Helicopter main routes: **Figure 12** identifies numerous helicopter main routes that are used to transfer equipment and personnel out to operational oil and gas platforms.
Marine Archaeology	The baseline environment for marine archaeology is illustrated in **Figure 11** and can be summarised in terms of: • Seabed archaeology: The archaeological resource contained within the Holocene sediments of the seabed remains poorly understood, primarily due to the practical limitations of carrying out archaeological investigations.

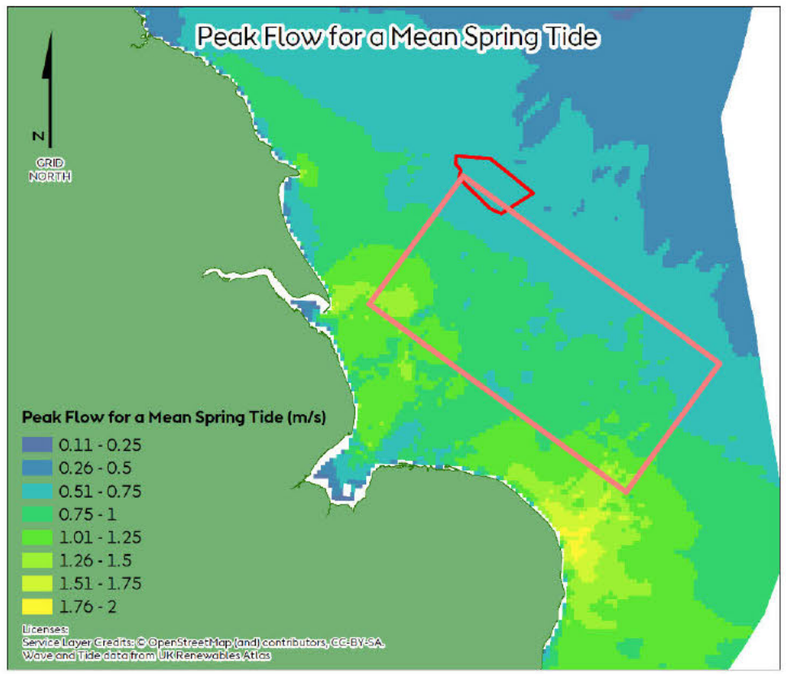
Topic	Summary of Baseline Environment
	• Archaeological resource: The North Sea marine archaeological resource is presented by three main classes of material and features: (1) submerged prehistoric landscaped caused by changes to sea level and eventual stabilisation of sea level at or near to the present position; (2) archaeological remains of watercraft deposited when vessels sank while at sea or became abandoned in an inter-tidal context which subsequently became inundated; and (3) remains of aircraft crash sites, either coherent assemblages or scattered material, usually the result of Second World War military conflict, but also numerous passenger casualties, particularly during the peak of seaplane activity during the inter-war period. • Wrecks: Numerous wrecks are illustrated in **Figure 11**, however in addition there are thought to be many more wrecks and features of interest that are currently undiscovered.
Seascape, Landscape and Visual Resources	The baseline environment for seascape, landscape and visual resources is illustrated in **Figure 13** and can be summarised in terms of: • Seascape: This AoS can be described as open sea with occasional offshore structure, such as oil and gas platforms and offshore wind farms. There is regular passage of use by sea-going vessels for a variety of purposes, including recreational and commercial fishing activities, commercial ferry routes, tankers, cargo vessels and recreational cruising. Additionally, combat training exercises in aeroplanes, search and rescue activities and standard helicopter operations to offshore infrastructure regularly occur across this location. • Designations: Numerous landscape designations including National Parks, Areas of Outstanding Natural Beauty and Heritage Coasts overlap with the coastline adjacent to the AoS, with views out to see being a prominent part of these landscapes.
Infrastructure and Other Users	The baseline environment for infrastructure and other users is illustrated in **Figure 14** and can be summarised in terms of: • Offshore development: The AoS sits within the southern North Sea, an area which contains a high density of offshore developments and marine industries due in part to its relatively shallow bathymetry. These includes offshore wind farms, oil and gas extraction, marine aggregate extraction, subsea cables and pipelines as well as emerging industries such as carbon capture and storage. Additionally, the baseline environment includes the activities associated with the construction, operation, maintenance and decommissioning of these activities.

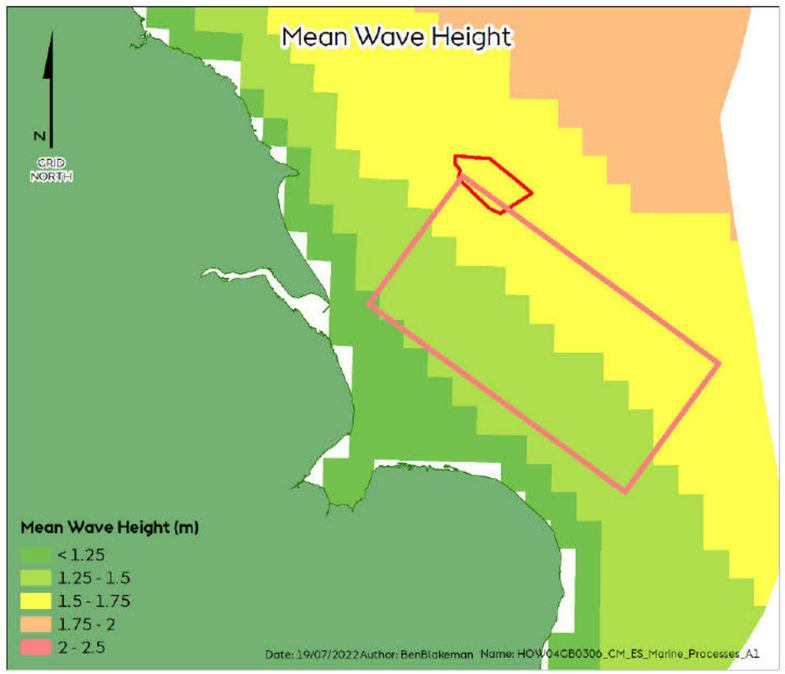




Hornsea Four
Compensation Measures
Areas of Search
Offshore Nesting
Southern North Sea
Marine Processes

Array Area
Offshore Nesting Area of Search





Coordinate system: ETRS 1989 UTM Zone 31N

0 50 100 Kilometres
0 25 50 Nautical Miles

REV	REMARK	DATE
---	First Issue	19/07/2022
A	Second Issue - Refined Search Areas	14/07/2022

Compensation Measures
Marine Processes
Document no: HOW04GB0306
Created by: BPHB
Checked by: TB
Approved by: LK

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Figure 5: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Physical Processes.

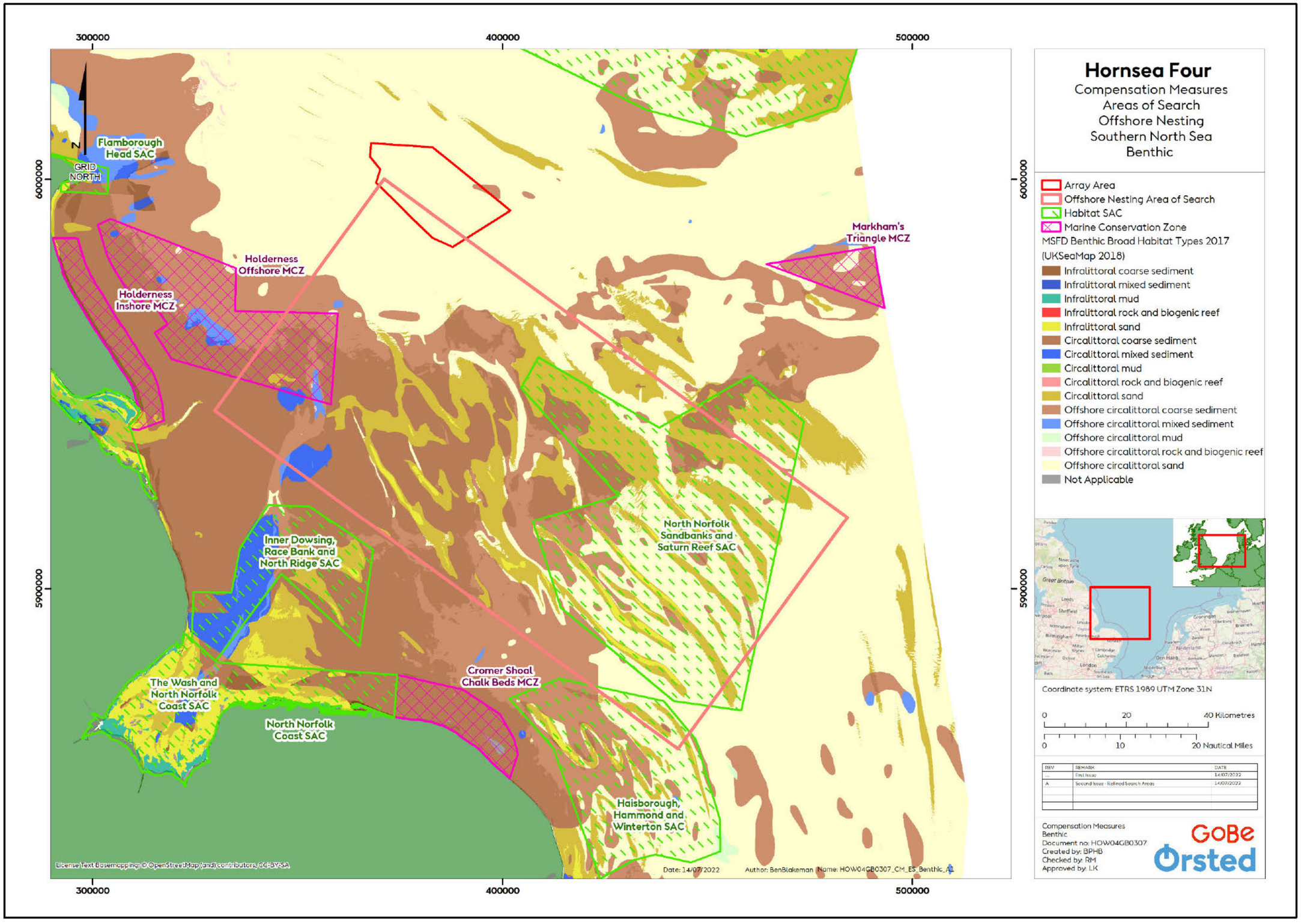


Figure 6: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Benthic.

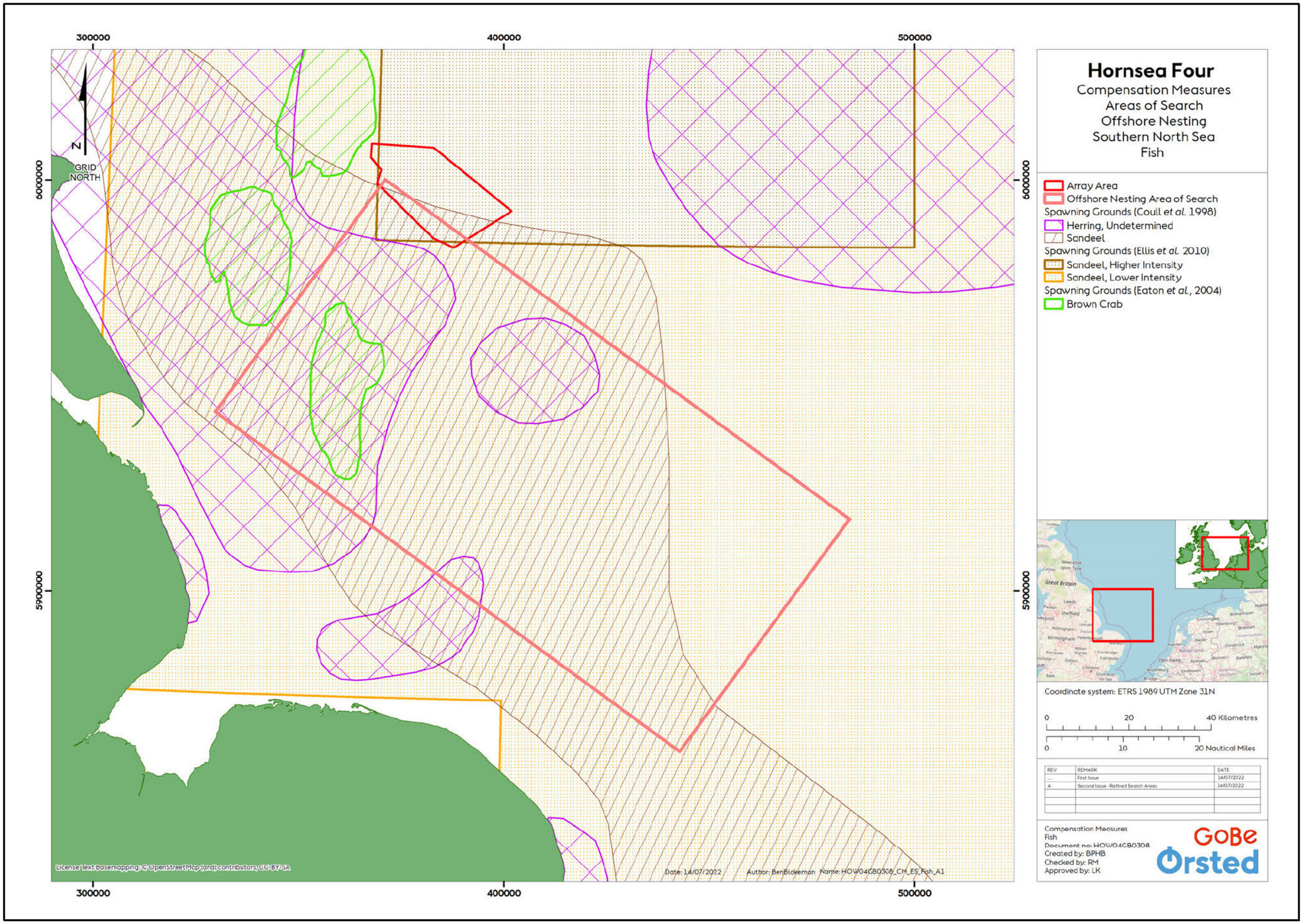
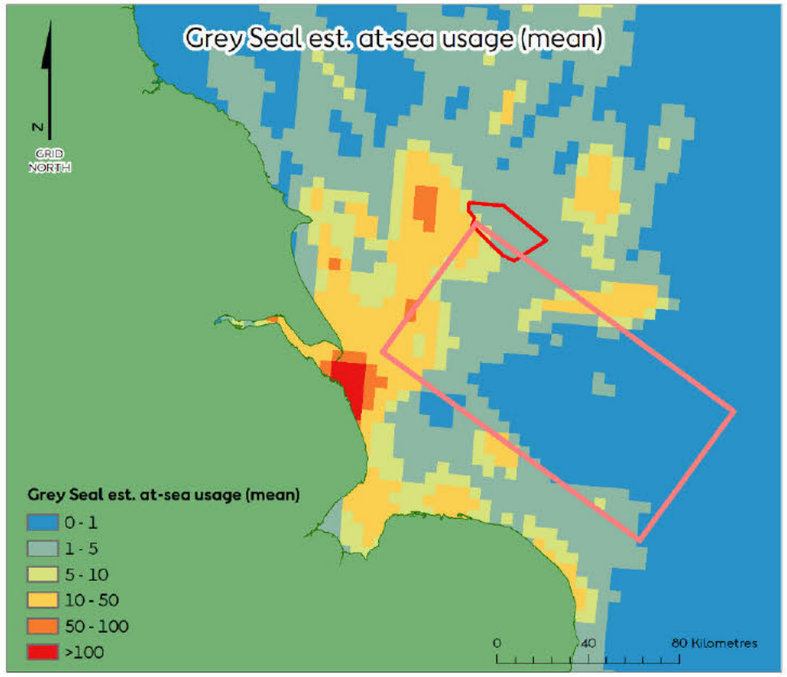
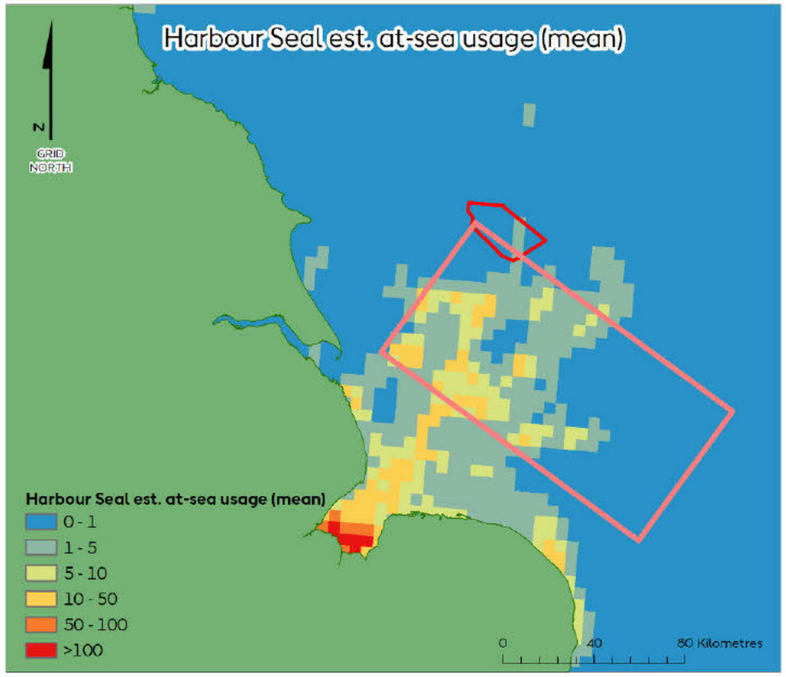
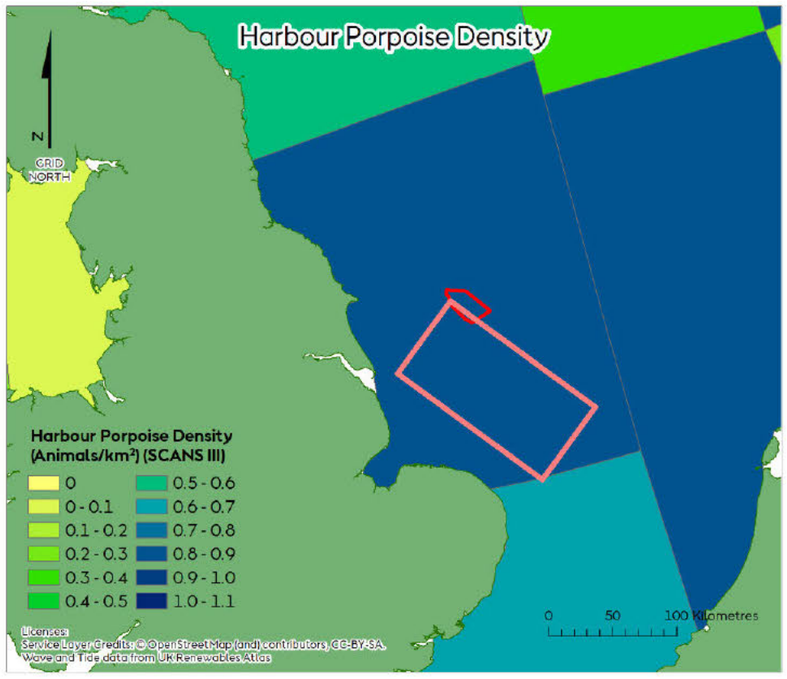
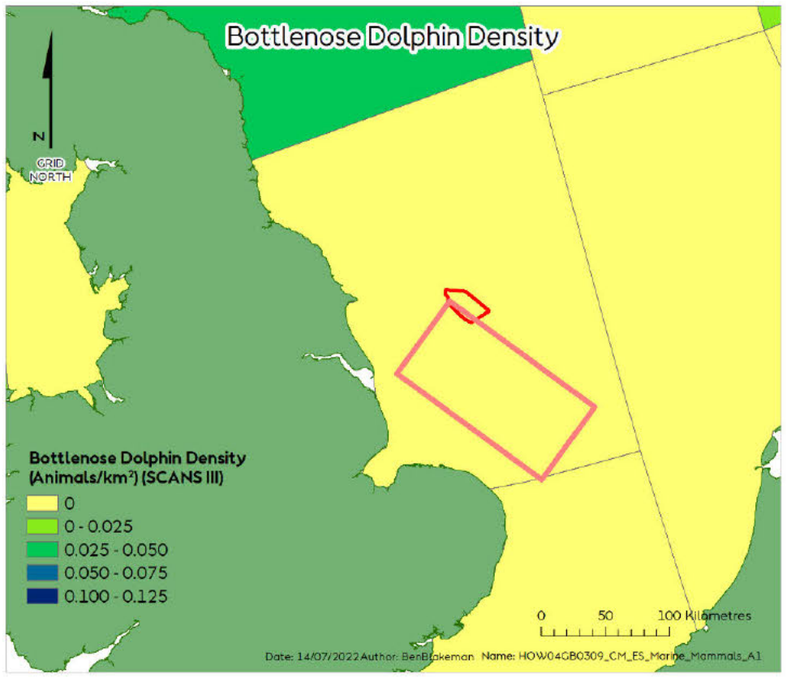


Figure 7: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Fish.









Hornsea Four

Compensation Measures
Areas of Search
Offshore Nesting
Southern North Sea
Marine Mammals

Array Area
Offshore Nesting Area of Search

Estimated at-sea Distribution of Grey and Harbour Seals maps data from Sea Mammal Research Unit (SMRU) and Marine Scotland, 2017

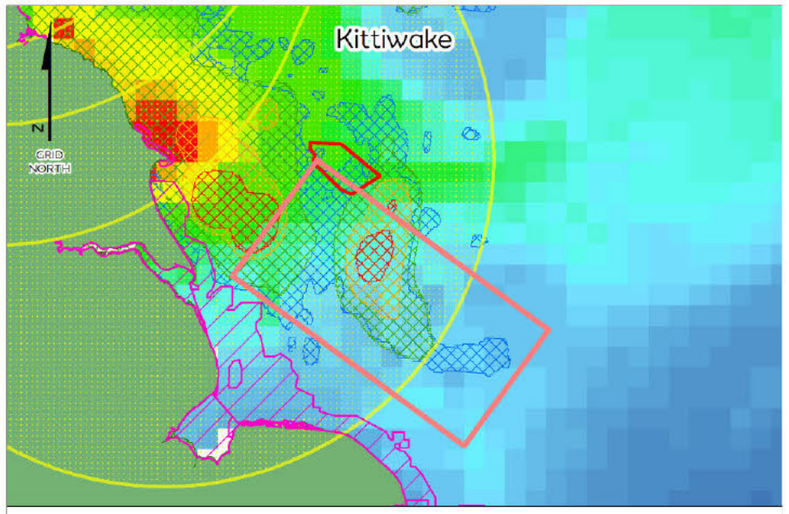
Coordinate system: ETRS 1989 UTM Zone 31N

REV	REMARK	DATE
---	First Issue	14/07/2022
A	Second Issue - Refined Search Areas	24/07/2022

Compensation Measures
Marine Mammals
Document no: HOW04GB0309
Created by: BPHB
Checked by: TB
Approved by: LK

GoBe
Ørsted

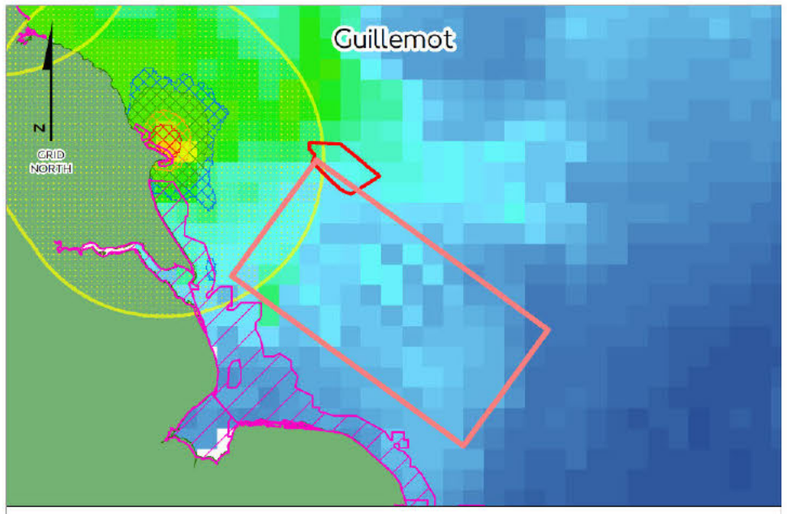
Figure 8: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Marine Mammals.



Kittiwake Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot
- Top 5% Getis-Ord hotspot
- Top 1% Getis-Ord hotspot

Kittiwake (Waggit et al., 2019) Density
High : 2.07
Low : 0

Hotspots identified at the UK-scale for Black-legged Kittiwakes using Getis-Ord hotspot analysis with a neighbourhood size of d = 10 km based on FPT analysis or Maximum Curvature. Getis-Ord hotspots defined as all cells with the top 1% of calculated GI* scores; all cells within the top 5% of GI* score; all cells in which GI* scores were deemed statistically significant at the < 0.01 level.



Guillemot Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 9km
- Top 5% Getis-Ord hotspot - d = 9km
- Top 1% Getis-Ord hotspot - d = 9km

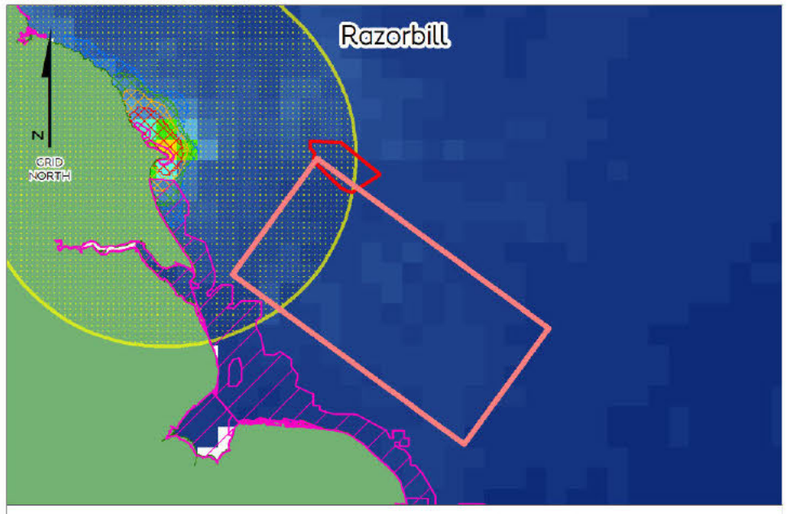
Guillemot (Waggit et al., 2019) Density
High : 6.25
Low : 0

Hotspots identified at the UK-scale for Common Guillemots using Getis-Ord hotspot analysis with a neighbourhood size of d = 9 km based on FPT analysis or Maximum Curvature.

Hornsea Four
Compensation Measures
Areas of Search
Offshore Nesting
Southern North Sea
Ornithology

- Array Area
- Offshore Nesting Area of Search
- Special Protection Area (SPA) with Marine Components

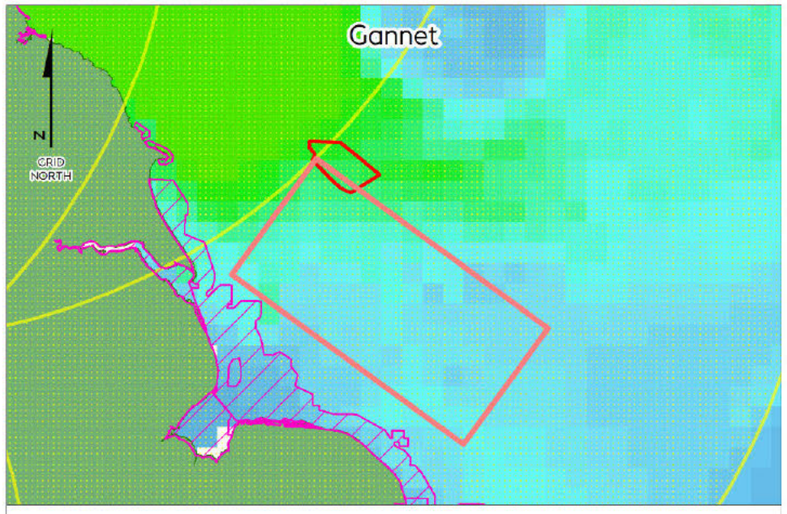
Mean-Max Foraging Range (Woodward 2019)
- Common Guillemot - 73.2km Buffer
- Gannet - 315.2km Buffer
- Kittiwake - 156.1km Buffer
- Razorbill - 88.7km Buffer



Razorbill Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 7km
- Top 5% Getis-Ord hotspot - d = 7km
- Top 1% Getis-Ord hotspot - d = 7km

Razorbill (Waggit et al., 2019) Density
High : 3
Low : 0

Hotspots identified at the UK-scale for Razorbills using Getis-Ord hotspot analysis with a neighbourhood size of d = 7 km based on FPT analysis or Maximum Curvature.



Gannet (Waggit et al., 2019) Density
High : 1.65
Low : 0

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Date: 14/07/2022 Author: BenBlakeman Name: HOW04GB0310_CM_ES_Ornithology_A1

Waggitt et al 2019 densities data. Spatial variation in predicted densities (animals per km) of seabird species in July in the North-East Atlantic. Values are provided at 10km resolution.

Coordinate system: ETRS 1989 UTM Zone 31N

0 50 100 Kilometres
0 25 50 Nautical Miles

REV	REMARK	DATE
--	First Issue	14/07/2022
A	Second Issue - Refined Search Areas	19/07/2022

Compensation Measures
Ornithology
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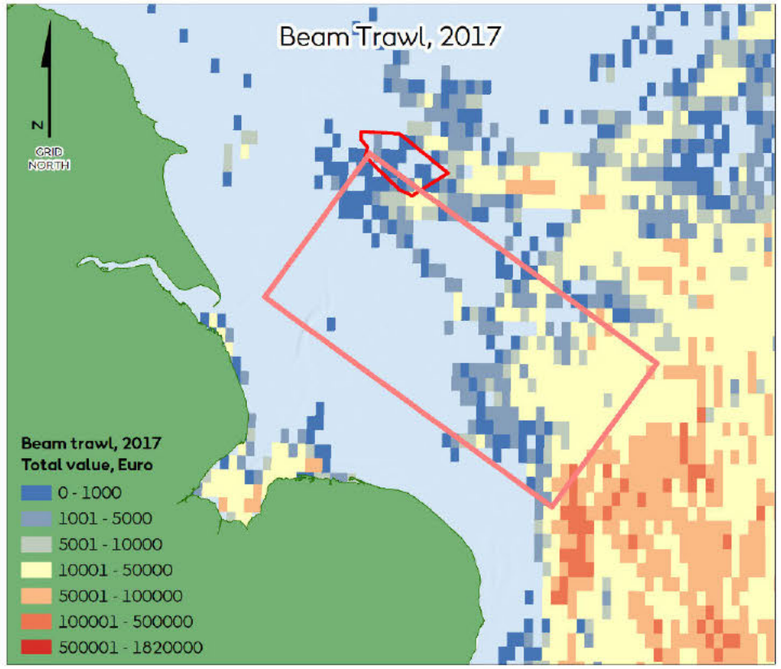
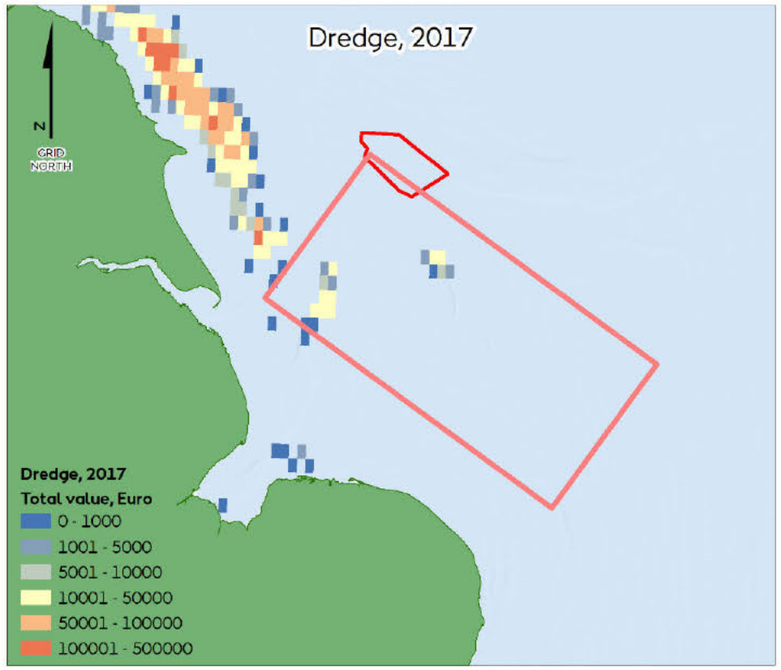
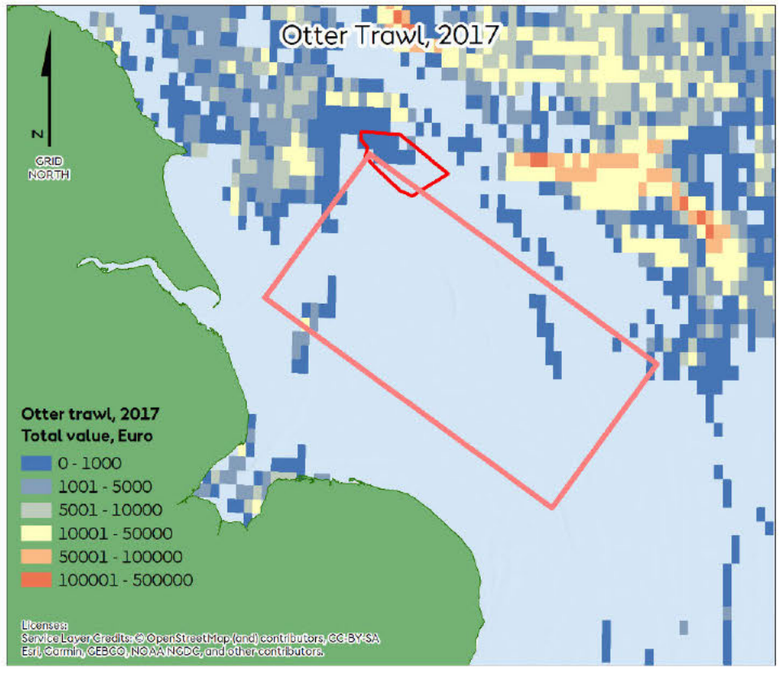
Figure 9: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Ornithology.

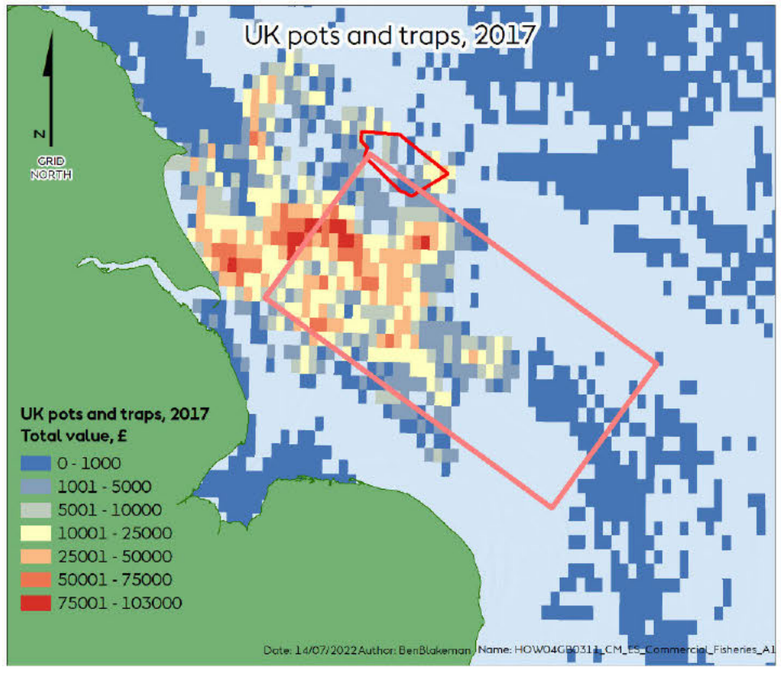




Hornsea Four
Compensation Measures
Areas of Search
Offshore Nesting
Southern North Sea
Commercial Fisheries

Array Area
Offshore Nesting Area of Search





Coordinate system: ETRS 1989 UTM Zone 31N

0 50 100 Kilometres
0 25 50 Nautical Miles

REV	REMARK	DATE
--	First issue	14/07/2022
A	Second issue - Refined Search Areas	14/07/2022

Compensation Measures
Commercial Fisheries
Document no: HOW04GB0311
Created by: BPHB
Checked by: TB
Approved by: LK

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Figure 10: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Commercial Fisheries.

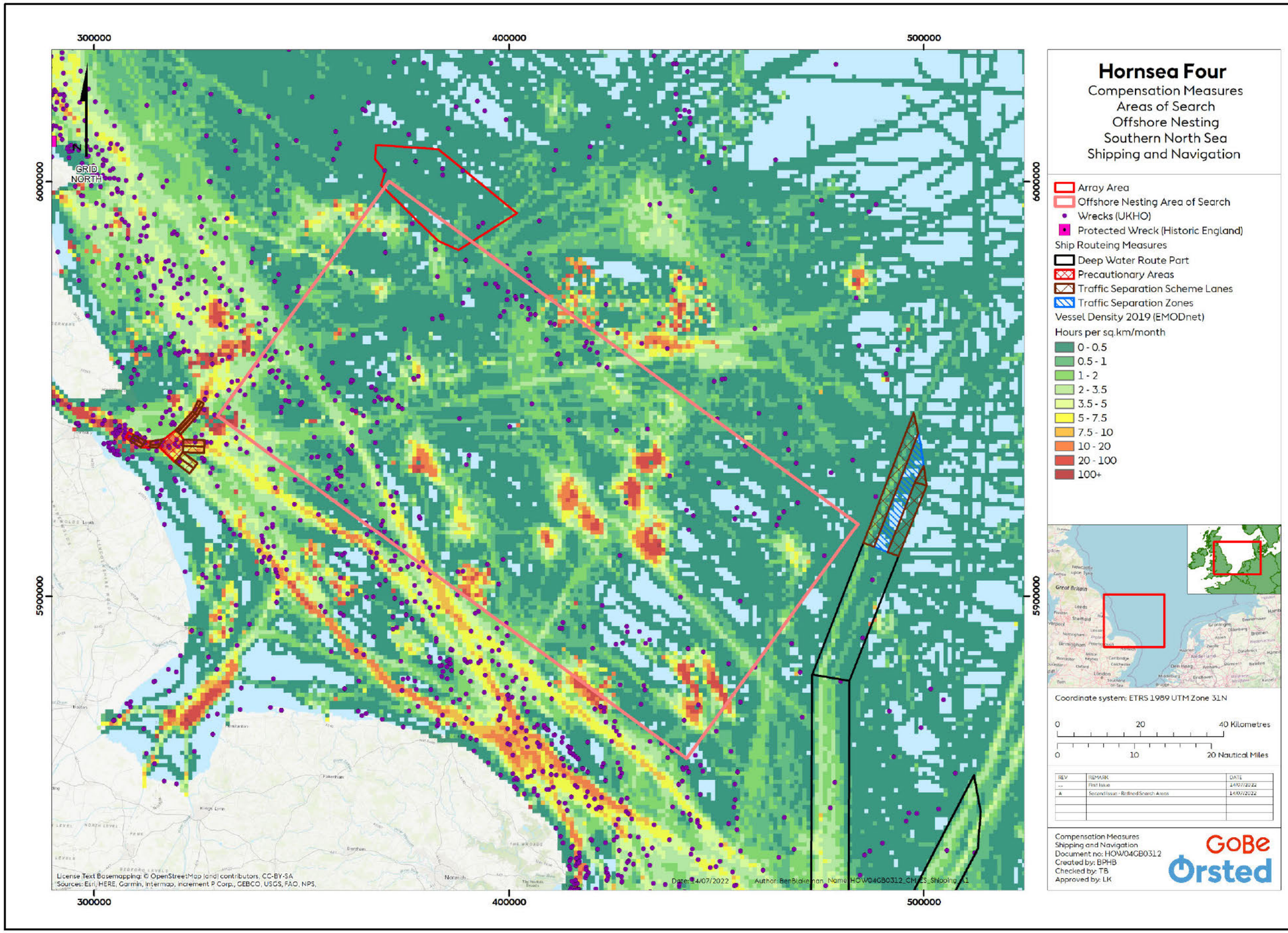
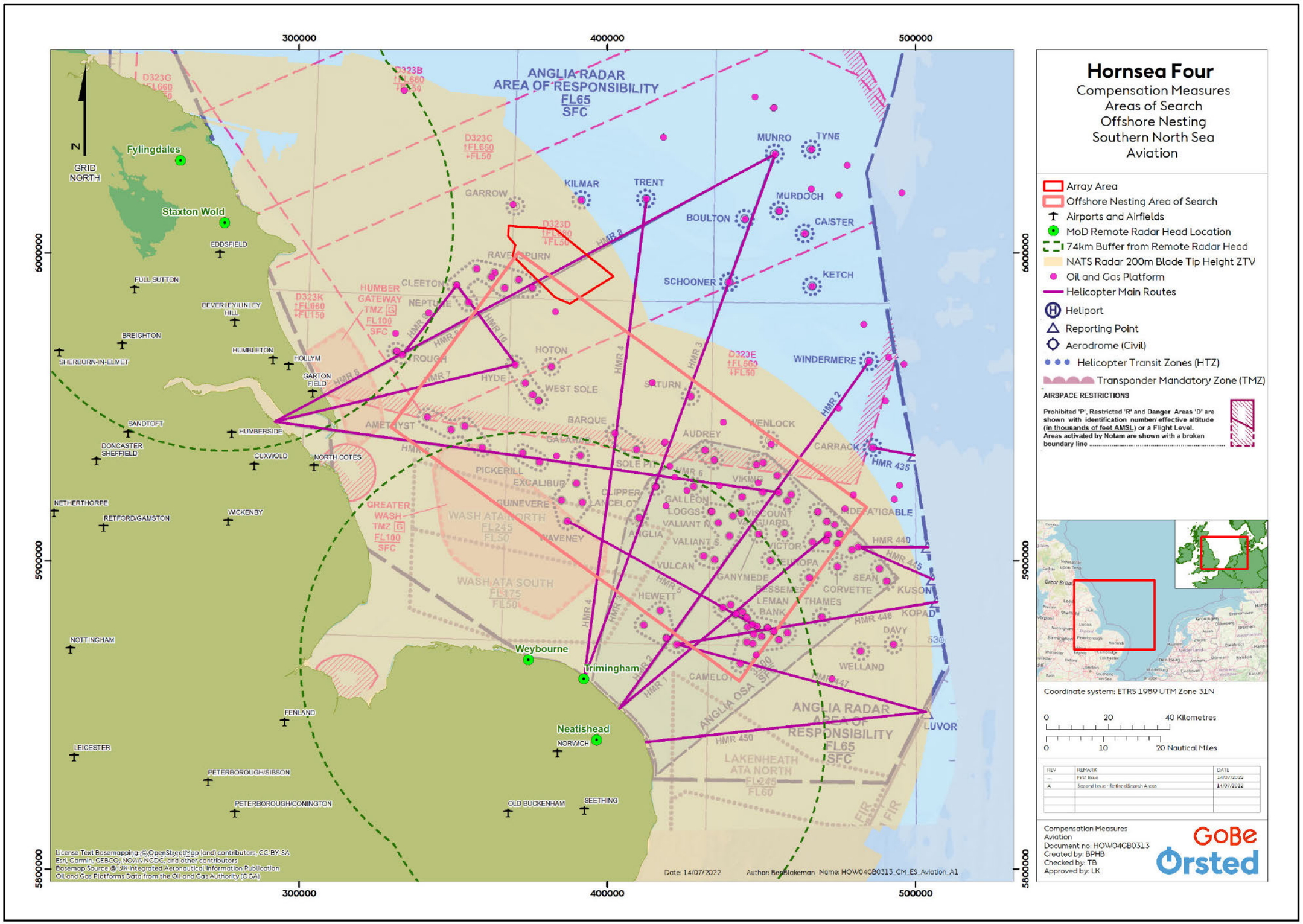


Figure 11: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Shipping and Navigation.



Hornsea Four

Compensation Measures
Areas of Search
Offshore Nesting
Southern North Sea
Aviation

- Array Area
- Offshore Nesting Area of Search
- Airports and Airfields
- MoD Remote Radar Head Location
- 74km Buffer from Remote Radar Head
- NATS Radar 200m Blade Tip Height ZTV
- Oil and Gas Platform
- Helicopter Main Routes
- Heliport
- Reporting Point
- Aerodrome (Civil)
- Helicopter Transit Zones (HTZ)
- Transponder Mandatory Zone (TMZ)

AIRSPACE RESTRICTIONS

Prohibited 'P', Restricted 'R' and Danger Areas 'D' are shown with identification number/ effective altitude (in thousands of feet AMSL) or a Flight Level. Areas activated by Notam are shown with a broken boundary line .....

Coordinate system: ETRS 1989 UTM Zone 31N

0 20 40 Kilometres

0 10 20 Nautical Miles

REV	REMARK	DATE
...	First Issue	14/07/2022
A	Second Issue - Refined Search Areas	14/07/2022

Compensation Measures
Aviation
Document no: HOW04GB0313
Created by: BPHB
Checked by: TB
Approved by: LK

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Figure 12: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Aviation.

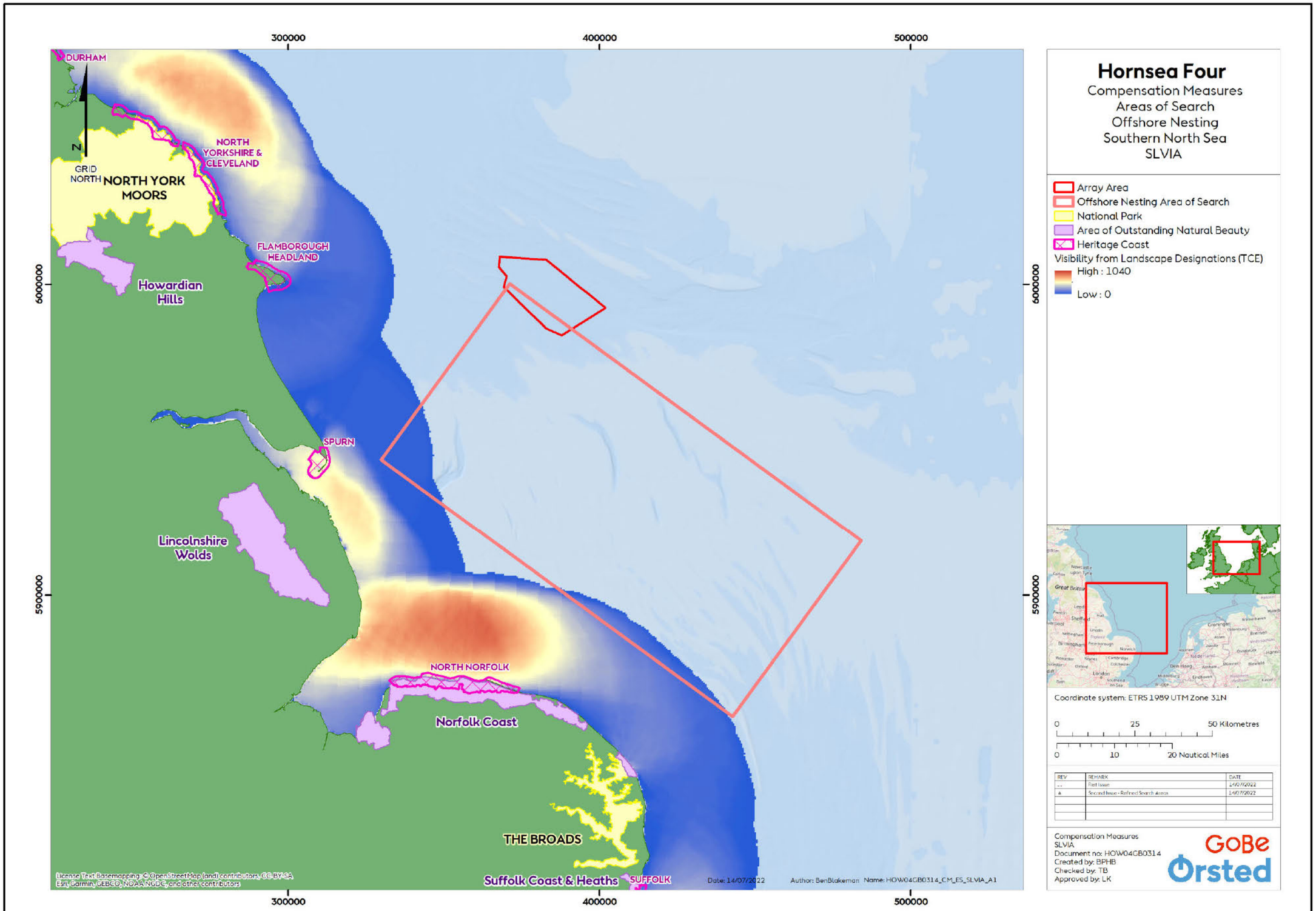


Figure 13: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea SLVIA.

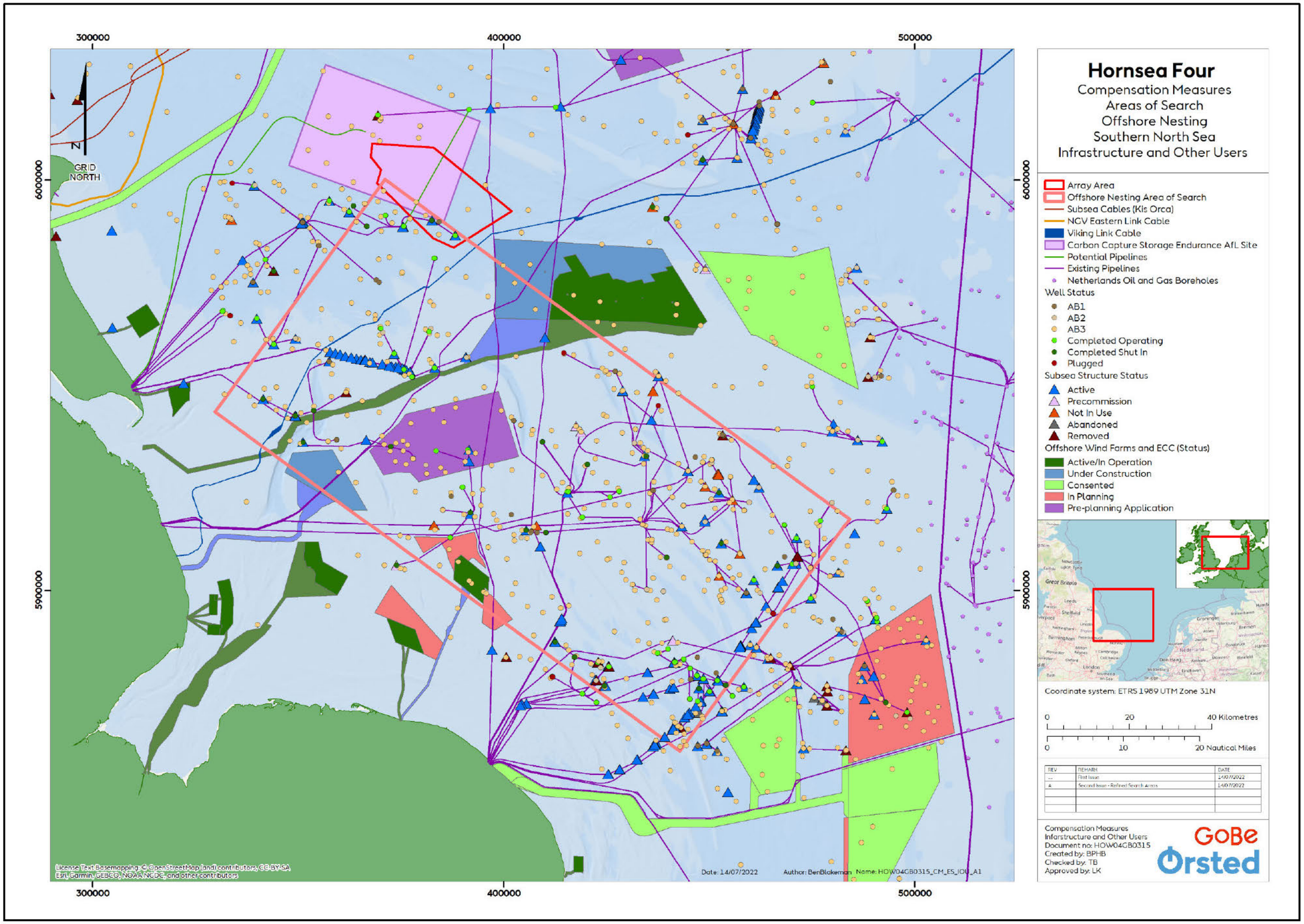


Figure 14: Compensation Measures Area of Search Offshore Nesting A1: Southern North Sea Infrastructure and Other Users.

7.3 Assessment

7.3.1 Identification of Impacts and Scope of Assessment

7.3.1.1 Based on the information presented in **A4.6.1: Compensation Project Description** (Deadline 7 submission) (and detailed in **Section 4.1.5**), all activities associated with the construction, implementation/O&M, and decommissioning of the new offshore artificial nesting structure Compensation Measure were defined and potential impact pathways identified.

7.3.1.2 **Table 7** details the impacts that were scoped out of the assessment at this stage alongside justification as to why each impact was scoped out.

7.3.1.3 All impacts considered to be scoped into the assessment are detailed in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

Table 7: New Offshore Artificial Nesting Structure – Impacts Scoped Out of Assessment.

EIA Topic	Phase	Potential Impact	Justification for Scoping Out
Benthic and Intertidal Ecology Fish and Shellfish Ecology Marine Mammals Offshore and Intertidal Ornithology	All Phases	Accidental release of pollutants (e.g. from accidental spillage/leakage) and resulting in potential effects on receptors.	The magnitude of an accidental spill incident will be limited by the size of chemical or oil inventory on construction vessels. In addition, released hydrocarbons would be subject to rapid dilution, weathering and dispersion and would be unlikely to persist in the marine environment. The likelihood of an incident will be reduced by implementation of a Project Environmental Management and Monitoring Plan (PEMMP), undertaken in accordance with CoC-OFF-7 (**A4.6.4: Compensation Commitments Register** (Deadline 7 submission)). This impact has therefore been scoped out of the assessment.
Benthic and Intertidal Ecology Fish and Shellfish Ecology	All Phases	Seabed disturbances leading to the release of sediment contaminants and resulting in potential effects on receptors.	Following any seabed disturbances, the majority of resuspended sediments are expected to be deposited within the immediate vicinity of the works. The release of any potential contaminants that may be present within the small proportion of fine sediments is likely to be rapidly dispersed with the tide and/or currents therefore increased bioavailability resulting in adverse eco-toxicological effects are not expected. As such and combined with the limited extent and duration of any seabed disturbances, the impact has been scoped out of the assessment.
Aviation and Radar	All Phases	Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore.	The locations, heights and lighting status of the offshore nesting structure will be reported to the Defence Infrastructure Organisation (DIO) and the Civil Aviation Authority (CAA)to allow inclusion on Aviation Charts in accordance with CoC-OFF-5 (**A4.6.4: Compensation Commitments Register** (Deadline 7 submission)). As such, the impact has been scoped out of the assessment.
Marine Archaeology	All Phases	Disturbance, removal, intrusion, compression and/or penetration of sediments containing archaeological receptors (material or contexts) leading to total or partial loss.	As a result of the implementation of a Marine Written Scheme of Archaeological Investigation (WSI) in accordance with CoC-OFF-2 and pre-construction surveys in accordance with CoC-OFF-14 (**A4.6.4: Compensation Commitments Register** (Deadline 7 submission)), and the impact being highly limited in extent, the impact has been scoped out of the assessment.
Marine Archaeology	Implementation/ O&M	Scour, penetration, draw down and compression effects caused by the presence of the foundations, impacting archaeological receptors and exposing such material to natural, chemical or	

EIA Topic	Phase	Potential Impact	Justification for Scoping Out
		biological processes and causing or accelerating loss of the same.	
Marine Archaeology	Implementation/ O&M	Penetration and compression effects on seabed caused by corrective and preventative operation and maintenance activities (via jack-up vessels or divers) leading to total or partial loss of archaeological receptors (material or contexts).	
Seascape, Landscape and Visual Resources	All Phases	All potential impacts on seascape, landscape and visual resources are scoped out due to lack of impact pathways.	The AoS is relatively well developed with oil and gas infrastructure. As such, the development is considered to be characteristic of the surrounding marine area and all potential impacts on seascape, landscape and visual resources from all phases of the Compensation Measure are scoped out of the assessment.
Infrastructure and Other Users	All Phases	All potential impacts on aggregate dredging activities, disposal sites, Carbon Capture and Storage (CCS) sites, cables and pipelines, Oil & Gas (O&G) activities.	In accordance with CoC-OFF-13 (**A4.6.4: Compensation Commitments Register** (Deadline 7 submission)), the offshore nesting structure will not be sited in immediate proximity to aggregate dredging activities, disposal sites, CCS sites, cables and pipelines, and Oil & Gas (O&G) activities. As such, all potential impacts on these receptors have been scoped out of the assessment.

7.3.2 Impact Assessment

7.3.2.1 **A4.6.3: Compensation Impacts Register** (Deadline 7 submission) identifies the potential scoped in impacts that could result from the installation/construction, implementation/O&M, and decommissioning of the new offshore artificial nesting structure Compensation Measure, relating to each technical topic under consideration in the EIA process. Each of these impacts have been considered, following the process outlined in **Section 6**, with the MDS defined, magnitude of impact and sensitivity of receptor considered and the level of significance derived by the matrix approach. The Compensation Impacts Register is presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

7.3.2.2 As presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission), it has been concluded that that no LSE is predicted for any of the potential impacts arising from the installation/construction, implementation/O&M and decommissioning of the new offshore artificial nesting structure Compensation Measure. As such, the potential effects to all receptors are therefore **not significant** in terms of the EIA Regulations (**A1.5: Environmental Impact Assessment Methodology (APP-011)**).

8 EIA – Repurposed Offshore Artificial Nesting Structure

8.1 Introduction

8.1.1.1 This section considers the potential impacts arising from the repurposed offshore artificial nesting structure Compensation Measure. A regional environmental characterisation of the physical, biological and human environmental baseline is presented alongside the results of an assessment of potential significant effects arising from the proposed Compensation Measure. Only one AoS has been identified for the repurposed offshore artificial nesting structure Compensation Measure (A1: Southern North Sea) and as such, the baseline and assessment within this section relates to this AoS alone.

8.2 Baseline

8.2.1.1 Due to the nature of this compensation measure, the baseline environment is the same as that described for the new offshore artificial nesting structure and therefore the summary of the baseline environment for AoS A1 is described in **Table 6** in **Section 7.2** above.

8.3 Assessment

8.3.1 Identification of Impacts and Scope of Assessment

8.3.1.1 Based on the information presented in **A4.6.1: Compensation Project Description** (Deadline 7 submission) (and summarised in **Section 4.1.5**). all activities associated with the construction, implementation/O&M and decommissioning of the new offshore artificial nesting structure Compensation Measure were defined and potential impact pathways identified.

8.3.1.2 **Table 7** details the impacts that were scoped out of the assessment at this stage alongside justification as to why each impact was scoped out.

8.3.1.3 All impacts considered to be scoped into the assessment are detailed in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

Table 8: Repurposed Offshore Artificial Nesting Structure – Impacts Scoped Out of Assessment.

EIA Topic	Phase	Potential Impact	Justification for Scoping Out
Marine Geology, Oceanography and Physical Processes	Implementation/ O&M	Scour of seabed sediments around foundation.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Benthic and Intertidal Ecology Fish and Shellfish Ecology Marine Mammals Offshore and Intertidal Ornithology	All Phases	Accidental release of pollutants (e.g. from accidental spillage/leakage) and resulting in potential effects on receptors.	The magnitude of an accidental spill incident will be limited by the size of chemical or oil inventory on construction vessels. In addition, released hydrocarbons would be subject to rapid dilution, weathering and dispersion and would be unlikely to persist in the marine environment. The likelihood of an incident will be reduced by implementation of a Project Environmental Management and Monitoring Plan (PEMMP), undertaken in accordance with CoC-OFF-7 (**A4.6.4: Compensation Commitments Register** (Deadline 7 submission)). This impact has therefore been scoped out of the assessment.
Benthic and Intertidal Ecology Fish and Shellfish Ecology	All Phases	Seabed disturbances leading to the release of sediment contaminants and resulting in potential effects on receptors.	Following any seabed disturbances, the majority of resuspended sediments are expected to be deposited within the immediate vicinity of the works. The release of any potential contaminants that may be present within the small proportion of fine sediments is likely to be rapidly dispersed with the tide and/or currents therefore increased bioavailability resulting in adverse eco-toxicological effects are not expected. As such and combined with the limited extent and duration of any seabed disturbances, the impact has been scoped out of the assessment.
Offshore and Intertidal Ornithology	Implementation/ O&M	The impact of physical displacement from an area around the structure may result in effective habitat loss and reduction in survival or fitness rates.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Offshore and Intertidal Ornithology		The impact of barrier effects caused by the physical presence of the structure may prevent clear transit of birds between foraging and breeding sites, or on migration.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Offshore and Intertidal Ornithology		The impact of attraction to lit structure by migrating birds in particular may cause disorientation, reduction in fitness and possible mortality.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.

EIA Topic	Phase	Potential Impact	Justification for Scoping Out
Marine Mammals Offshore and Intertidal Ornithology	All Phases	Increased vessel traffic resulting in disturbance to receptors	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Commercial Fisheries	Implementation/ O&M	Increased vessel traffic within fishing grounds as a result of changes to shipping routes and maintenance vessel traffic from the structure leading to interference with fishing activity.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Shipping & Navigation	Installation/ Construction	Structure will create powered and drifting allision risk for all vessels.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Shipping & Navigation	Implementation/ O&M	Presence of structure may cause vessels to be deviated leading to increased encounters and therefore increased vessel to vessel collision risk for all vessel in all weather conditions.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Shipping & Navigation	Implementation/ O&M	Maintenance activities may cause vessels to be deviated leading to increased encounters and therefore may also lead to increased vessel to vessel collision risk for all vessels in all weather conditions.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Aviation and Radar	All Phases	Continuation of aviation obstacle to fixed wing and rotary aircraft operating offshore.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Marine Archaeology	All Phases	Disturbance, removal, intrusion, compression and/or penetration of sediments containing archaeological receptors (material or contexts) leading to total or partial loss.	As a result of the implementation of a Marine Written Scheme of Archaeological Investigation (WSI) in accordance with CoC-OFF-2 and pre-construction surveys in accordance with CoC-OFF-14 (**A4.6.4: Compensation Commitments Register** (Deadline 7 submission)), and the impact being highly limited in extent, the impact has been scoped out of the assessment.
Marine Archaeology	Implementation/ O&M	Scour, penetration, draw down and compression effects caused by the presence of the foundations, impacting archaeological receptors and exposing such material to natural, chemical or biological	

EIA Topic	Phase	Potential Impact	Justification for Scoping Out
		processes and causing or accelerating loss of the same.	
Marine Archaeology	Implementation/ O&M	Penetration and compression effects on seabed caused by corrective and preventative operation and maintenance activities (via jack-up vessels or divers) leading to total or partial loss of archaeological receptors (material or contexts).	
Seascape, Landscape and Visual Resources	All Phases	All potential impacts on seascape, landscape and visual resources are scoped out due to lack of impact pathways.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.
Infrastructure and Other Users	All Phases	All potential impacts on aggregate dredging activities, disposal sites, Carbon Capture and Storage (CCS) sites, cables and pipelines, Oil & Gas (O&G) activities, recreational craft, and recreational fishing vessels.	Existing structure forms part of the baseline environment. As such, this impact has been scoped out of the assessment.

8.3.2 Impact Assessment

8.3.2.1 **A4.6.3: Compensation Impacts Register** (Deadline 7 submission) identifies the potential scoped in impacts that could result from the installation/construction, implementation/O&M, and decommissioning of the repurposed offshore artificial nesting structure Compensation Measure, relating to each technical topic under consideration in the EIA process. Each of these impacts have been considered, following the process outlined in **Section 6**, with the MDS defined, magnitude of impact and sensitivity of receptor considered and the level of significance derived by the matrix approach. The Compensation Impacts Register is presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

8.3.2.2 As presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission), it has been conclude that no LSE is predicted for any of the potential impacts arising from the installation/construction, implementation/O&M and decommissioning of the repurposed offshore artificial nesting structure Compensation Measure. As such, the potential effects to all receptors are therefore **not significant** in terms of the EIA Regulations (**A1.5: Environmental Impact Assessment Methodology (APP-011)**).

9 EIA – New Onshore Artificial Nesting Structure

9.1 Introduction

9.1.1.1 This section considers the potential impacts arising from the new onshore artificial nesting structure Compensation Measure. A regional environmental characterisation of the physical, biological and human environmental baseline is presented alongside the results of an assessment of potential significant effects arising from the proposed Compensation Measure. One AoS has been identified for the new onshore artificial nesting structure Compensation Measure: B1 (Cayton Bay to Newbiggin by the Sea).

9.2 Baseline

9.2.1.1 **Table 9** provides a summary of the baseline environment for AoS B1 (Cayton Bay to Newbiggin by the Sea).

9.2.1.2 **Figure 15** to **Figure 20** identify statutory, non-statutory and historic environment designations within the AoS (where spatial data is publicly available). Due to the scale of AoS B1, the figures have been split into north and south.

Table 9: Summary of baseline environment in relation to the Area of Search (Cayton Bay to Newbiggin by the Sea) for new onshore nesting structure.

Topic	Summary of Baseline Environment
Geology and Ground Conditions	• The Bedrock Aquifer Designation ranges from predominately Principal north of Hartlepool to Secondary B and Secondary (undifferentiated) between Hartlepool to Redcar. The remainder to the south is Secondary A. • The Superficial Drift Aquifer Designation is predominately Secondary (undifferentiated) within the entirety of the AoS.
Hydrology and Flood Risk	• The majority of coastline is within Flood Zone 3 and there are several main rivers within the AoS including the River Tyne, River Wear, River Tees and River Esk.
Historic Environment	• 2506 Listed Buildings • 70 Scheduled Monuments • One World Heritage Site within the AoS (*Frontiers of the Roman Empire (Hadrian's Wall)*) • One Registered Battlefield (*Battle of Newburn Ford 1640)*
Ecology	• 39 Local Nature Reserves • 31 SSSIs • Four SACs (*Beast Cliff-Whitby (Robin Hood's Bay), Castle Eden Dene, Durham Coast* and *North York Moors*) • Four SPAs (*North York Moors, Northumberland Marine, Northumbria Coast and Teesmouth* and *Cleveland Coast*) • Two Ramsar sites (*Northumbria Coast and Teesmouth* and *Cleveland Coast*) • One RSPB Reserve (*Saltholme*) and two RSPB Important Bird Areas (*North Yorkshire Moors, Northumbria Coast and Teesmouth* and *Cleveland Coast*)
Landscape and Visual	• No AONBs within AoS • This AoS includes several National Character Areas
Land Use and Agriculture	• Land use is predominately rural. However, there are urbanised and industrialised cities within the AoS such as Newcastle Upon Tyne, Sunderland and Hartlepool. • The majority of AoS is Agricultural Land Classification Grade 3.
Traffic and Transport	• No baseline information been collated due to the scale of the AoS, however the road network includes those within Newcastle upon Tyne, Sunderland, Hartlepool and Middlesbrough as well as a number of routes in parallel with the coastline.
Noise and Vibration	• Defra strategic noise map data identifies a number of Noise Important Areas along the length of the AoS. These are predominately located along roads within urban areas such as Scarborough, Coatham, Sunderland, South Shields and Newcastle. Baseline noise levels are highest along major roads within the previously mentioned locations. Baseline noise levels are low within the AoS in rural locations where the nesting structure is likely to be located.
Air Quality	• There are several Air Quality Management Areas (AQMAs) within the AoS (Scarborough AQMA – declared for Particulate Matter PM_{10} and several within the urban areas of Newcastle Upon Tyne)
Socio-Economic	• The AoS contains a wide range of economic activities including agriculture, tourism and industrial. Parts of the AoS in south Northumberland, North Tyneside, Newcastle upon Tyne, Sunderland, Hartlepool, Middlesbrough, Redcar and North Yorkshire include areas within the most 10% economically deprived neighbourhoods in England.
Health	• Parts of the AoS in south Northumberland, North Tyneside, Newcastle upon Tyne, Sunderland, Hartlepool, Middlesbrough, Redcar and North Yorkshire include areas within the most 10% health deprived neighbourhoods in England.

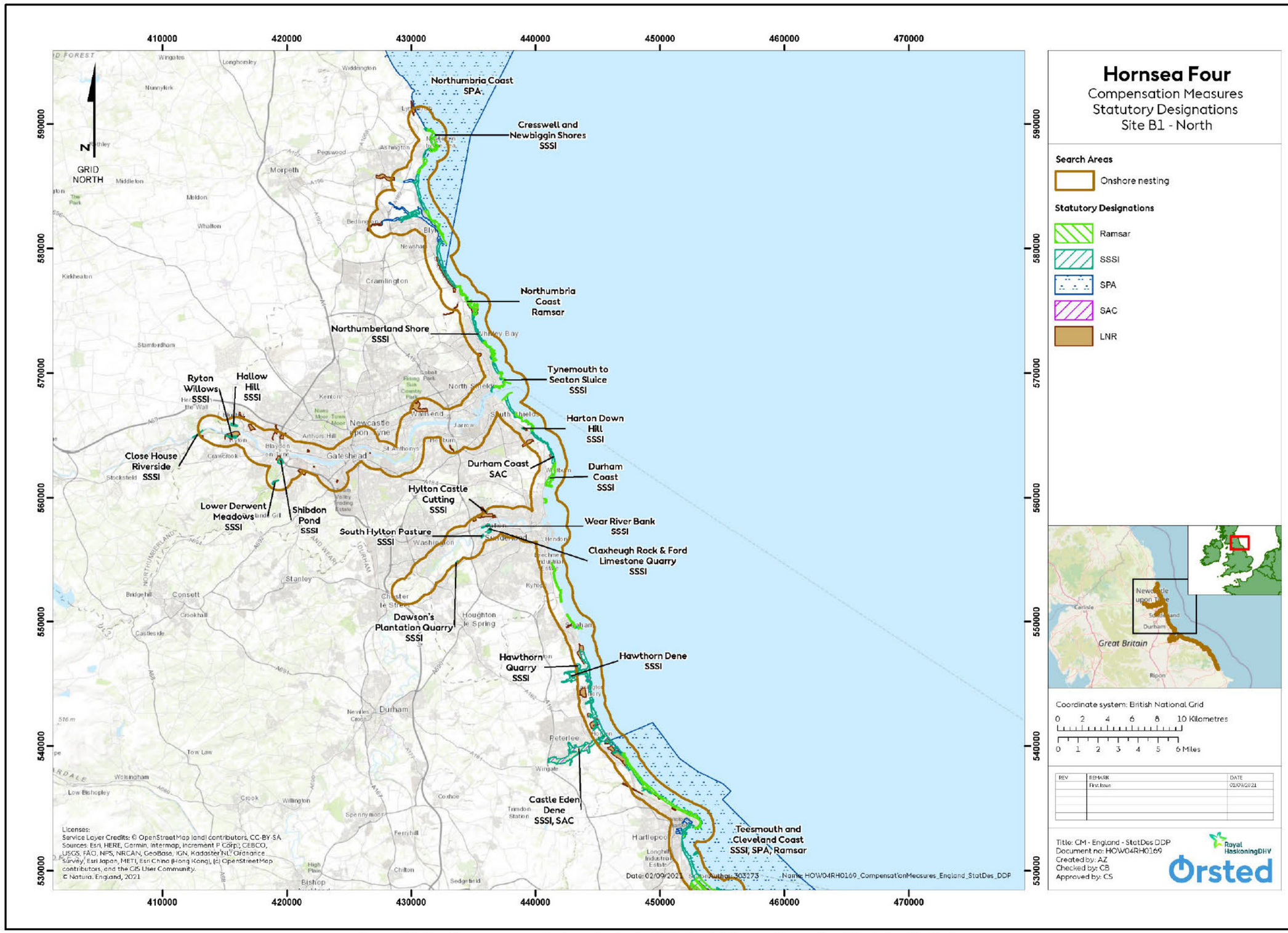


Figure 15: Baseline statutory designation for AoS B1 North (Cayton Bay to Newbiggin by the Sea).

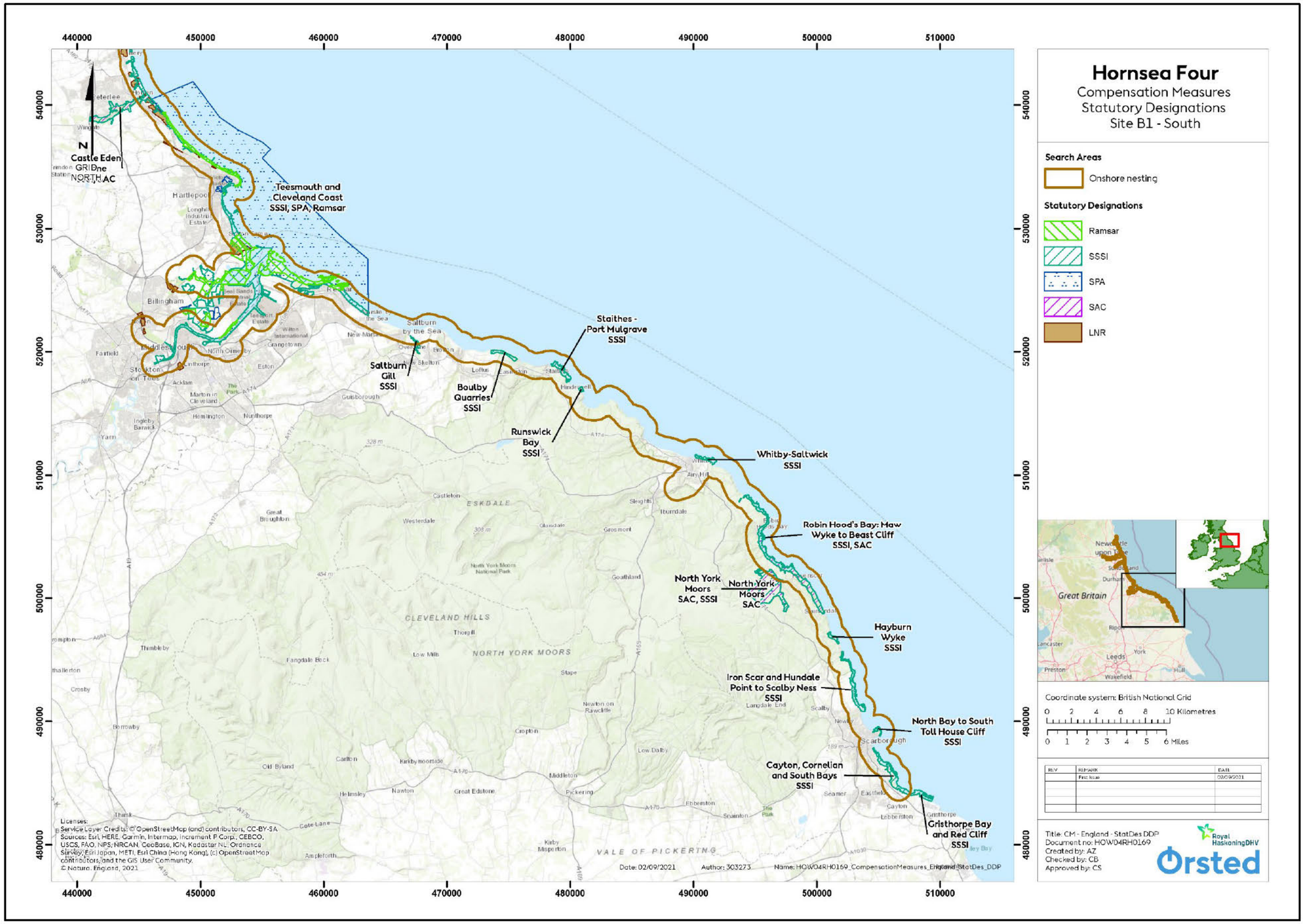


Figure 16: Baseline statutory designation for AoS B1 South (Cayton Bay to Newbiggin by the Sea).

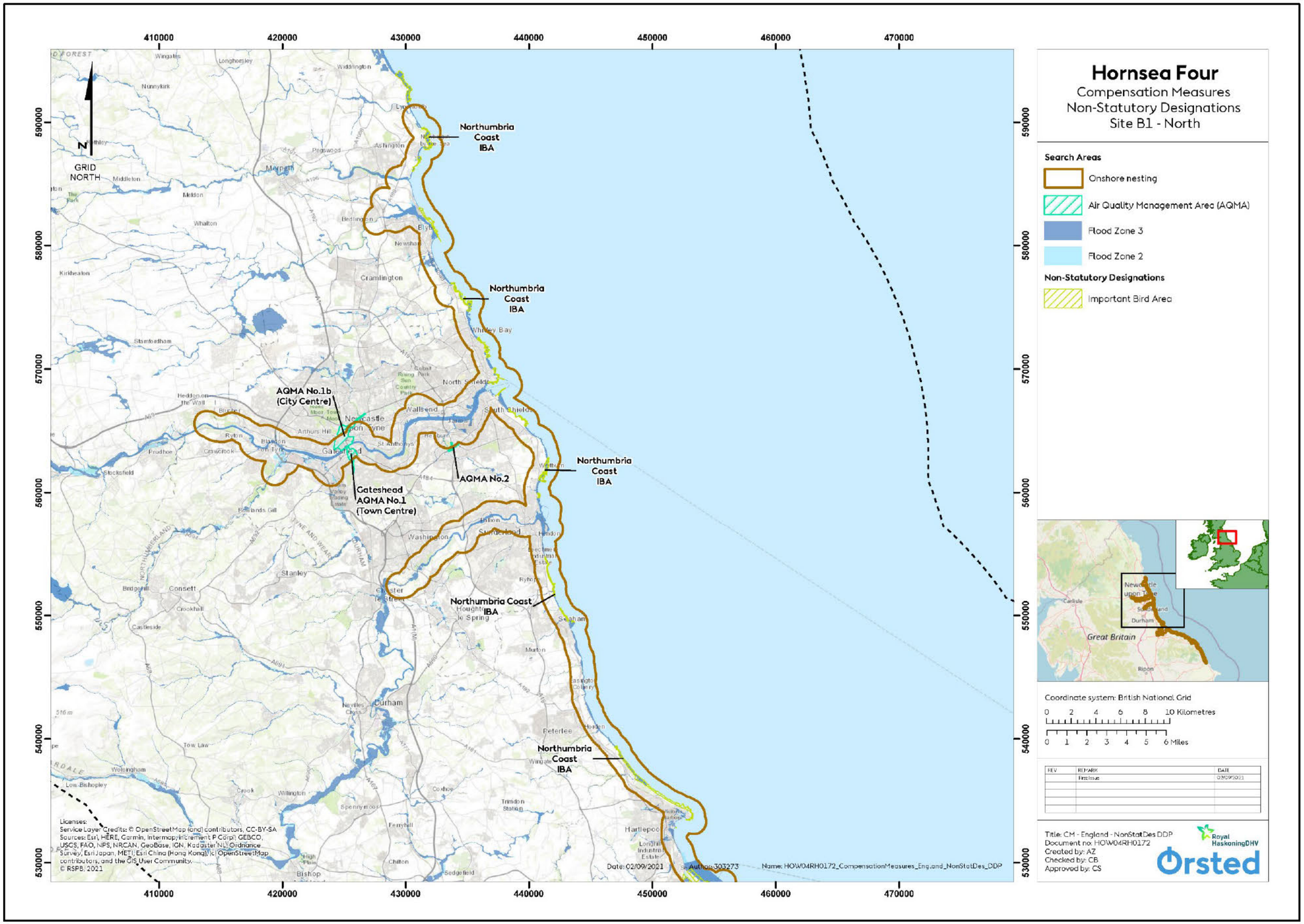


Figure 17: Baseline non-statutory designation for AoS B1 North (Cayton Bay to Newbiggin by the Sea).

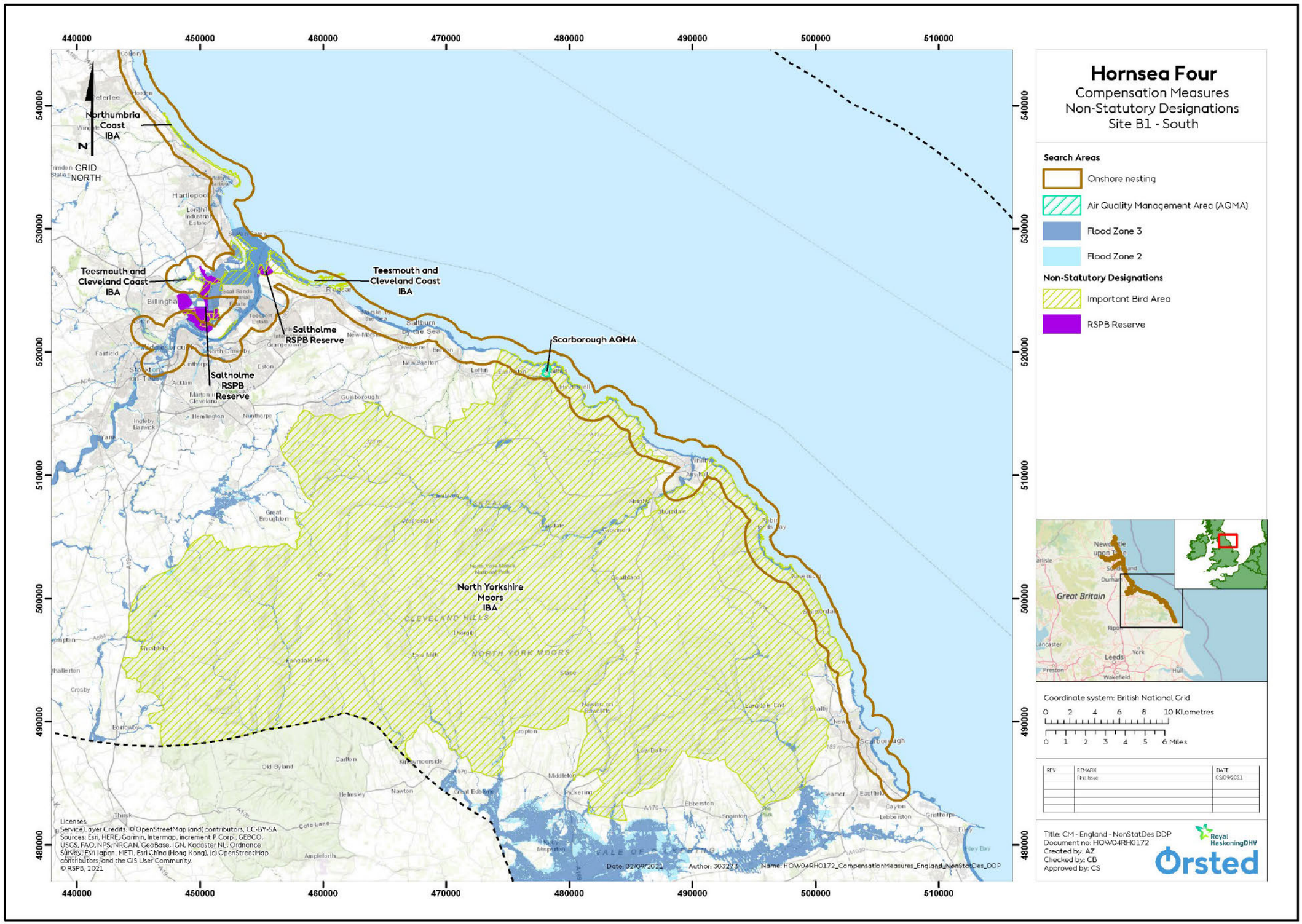


Figure 18: Baseline non-statutory designation for AoS B1 South (Cayton Bay to Newbiggin by the Sea).

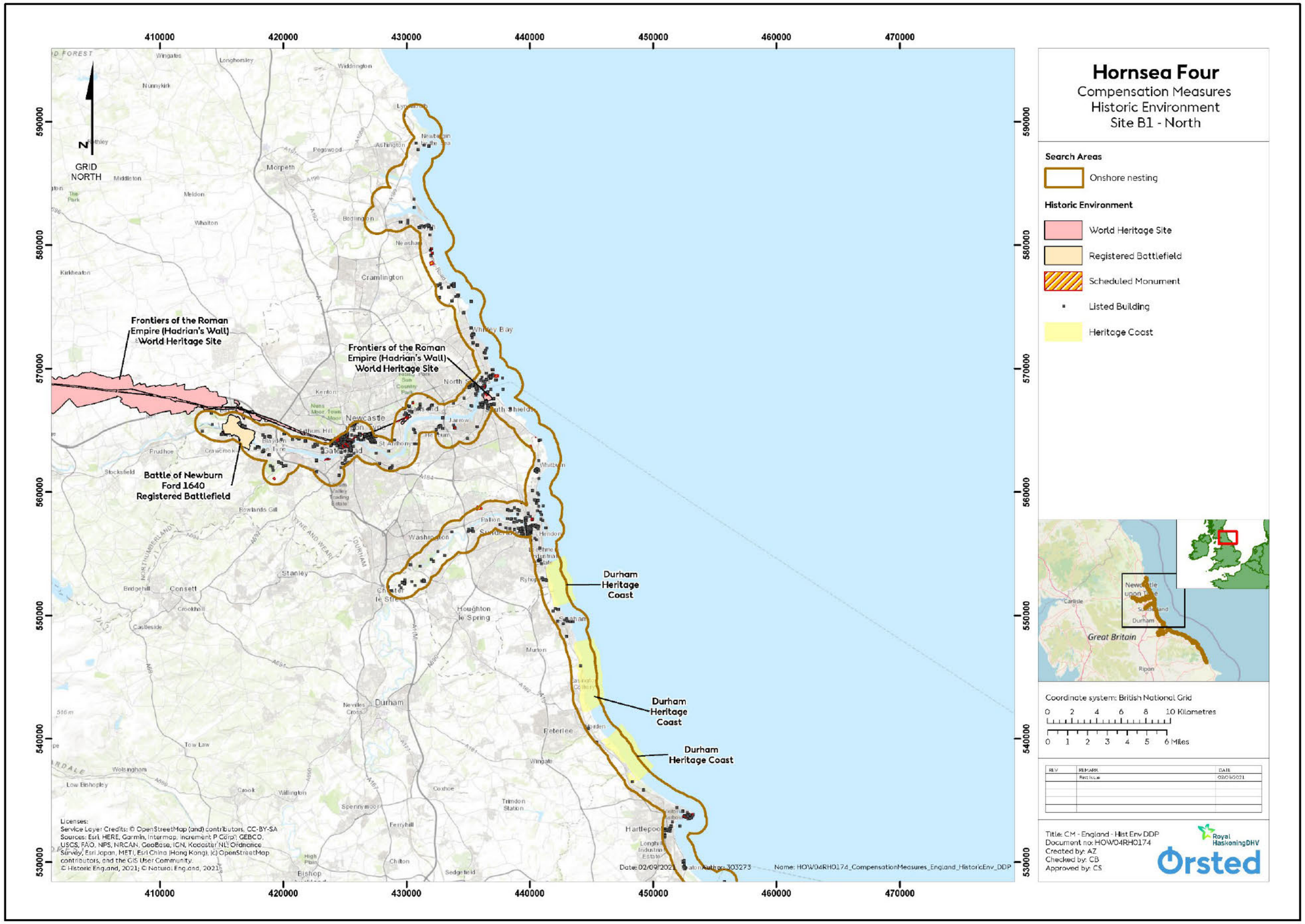


Figure 19: Baseline historic environment designation for AoS B1 North (Cayton Bay to Newbiggin by the Sea).

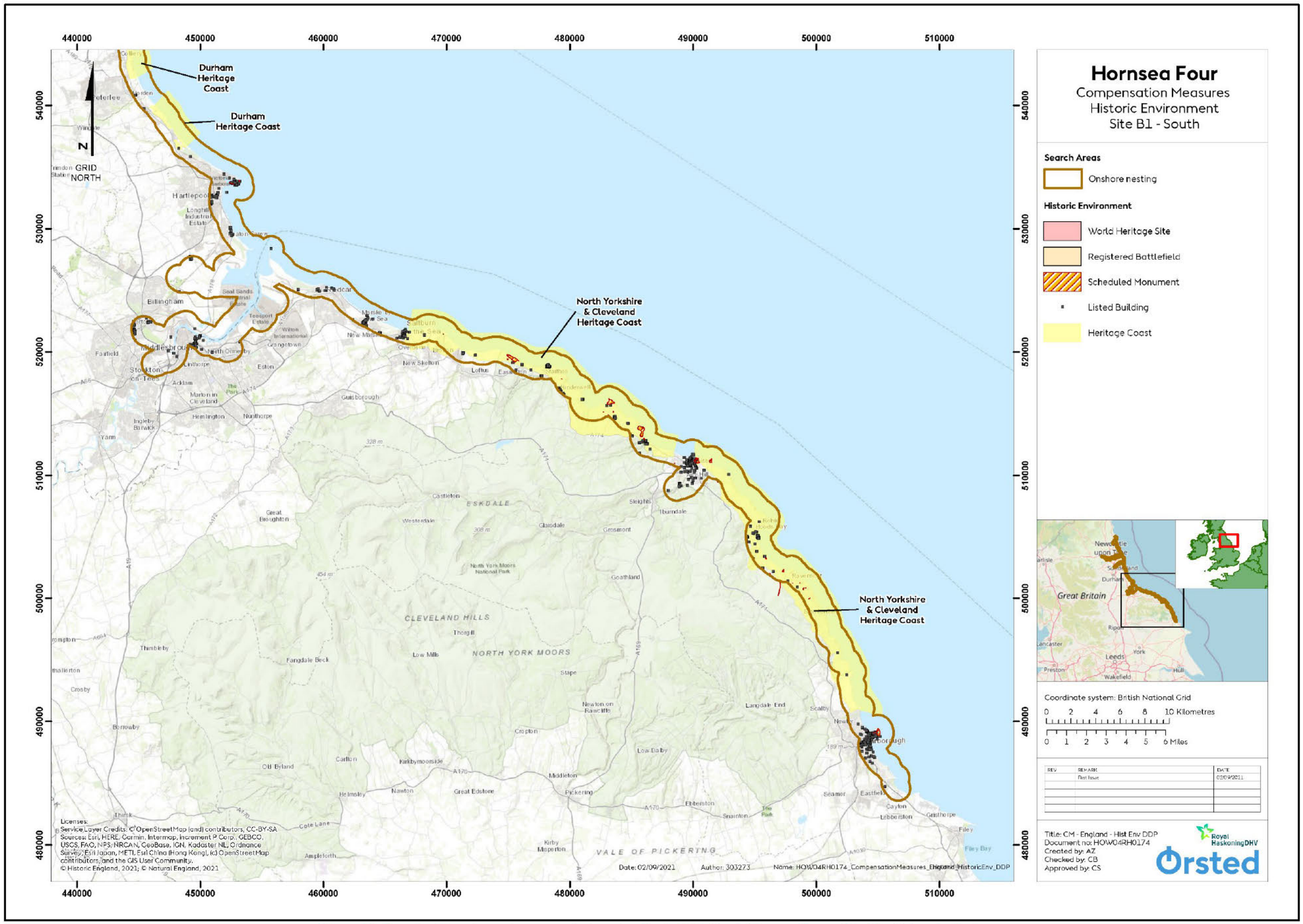


Figure 20: Baseline historic environment designation for AoS B1 South (Cayton Bay to Newbiggin by the Sea).

9.3 Assessment

9.3.1 Identification of Impacts and Scope of Assessment

9.3.1.1 Based on the information presented in **A4.6.1: Compensation Project Description** (Deadline 7 submission) (and summarised in **Section 4.1.6**), all activities associated with the construction, implementation/O&M and decommissioning of the new onshore artificial nesting structure Compensation Measure were defined and potential impact pathways identified.

9.3.1.2 All impacts considered to be scoped into the assessment are detailed in **A4..3: Compensation Impacts Register** (Deadline 7 submission). No impacts were scoped out of the assessment.

9.3.2 Impact Assessment

9.3.2.1 **A4.6.3: Compensation Impacts Register** (Deadline 7 submission) identifies the potential scoped in impacts that could result from the installation/construction, implementation/operation, and decommissioning of the new onshore nesting structure Compensation Measure, relating to each technical topic under consideration in the EIA process. Each of these impacts have been considered, following the process outlined in **Section 6**, with the MDS defined, magnitude of impact and sensitivity of receptor considered and the level of significance derived by the matrix approach. The Compensation Impacts Register is presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

9.3.2.2 No impacts are identified in the 'Onshore Nesting Structure' tab of **A4.6.3: Compensation Impacts Register** (Deadline 7 submission) as having potential for LSE in relation to the installation/construction, implementation/operation, and decommissioning of the predator eradication Compensation Measure.

9.4 Summary: New Onshore Artificial Nesting Structure EIA

9.4.1.1 As outlined above, no impacts are identified as having potential for LSE in relation to the installation/construction, implementation/operation, and decommissioning of the Onshore Artificial Nesting Structure Compensation Measure. Further assessment is required at a later stage for impacts relating to currently unknown MDS parameters.

10 EIA – Bycatch Reduction Technology

10.1 Introduction

10.1.1.1 This section considers the potential impacts arising from the bycatch reduction technology Compensation Measure. The AoS has been identified for the bycatch reduction technology Compensation Measure (the South coast of England).

10.2 Assessment and Baseline

10.2.1.1 As detailed in **Section 6.5,** the scope of baseline characterisation has been made relevant to the scope of the EIA in that if a specific EIA topic has been scoped out of the assessment in relation to particular Compensation Measure, then the baseline for that particular topic is not presented. Based on the information presented in **A4.6.1: Compensation Project Description** (Deadline 7 submission) (and detailed in **Section 4**), all activities associated with the construction, implementation/O&M, and decommissioning of the bycatch reduction technology Compensation Measure were defined and potential impact pathways identified. As presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission), no impact pathways have been identified, therefore there are no impacts to be assessed and no baseline characterisation is required.

11 EIA – Predator Eradication

11.1 Introduction

11.1.1.1 This section considers the potential impacts arising from the predator eradication Compensation Measure. A regional environmental characterisation of the physical, biological and human environmental baseline is presented alongside the results of an assessment of potential significant effects arising from the proposed Compensation Measure. One AoS has been identified for the Predator Eradication Compensation Measure D1 (Bailiwick of Guernsey).

11.2 Baseline

11.2.1.1 **Table 10** provides a summary of the baseline environment for AoS D1 (Bailiwick of Guernsey).

11.2.1.2 **Figure 21** identifies statutory, non-statutory and historic environment designations within the AoS (where spatial data is publicly available).

Table 10: Summary of baseline environment in relation to the D1 (Bailiwick of Guernsey) Area of Search for predator eradication.

Topic	AoS D1 (Bailiwick of Guernsey)
Geology and Ground Conditions	• Geology and ground conditions baseline information has not been collated to date due to a lack of easily obtainable publicly available information.
Hydrology and Flood Risk	• Flood risk or hydrogeology. baseline information has not been collated to date due to a lack of easily obtainable publicly available information.
Historic Environment	• The States of Guernsey Protected Trees, Buildings & Monuments Webmap[6]identifies a high number of protected monuments and buildings in the AoS
Ecology	• Four Ramsar (*Gouliot Caves, Headland and Herm, Jethou and The Humps, Lihou Island & L'Erée Island, and Alderney West Coast & the Burhou Islands*) • Ten SSSIs • Many areas are designated Areas of Biodiversity Importance.
Landscape and Visual	• No AONBs • No Heritage Coasts
Land Use and Agriculture	• Land use is predominately agricultural.
Traffic and Transport	• Traffic and transport baseline information has not been collated to date due to a lack of easily obtainable publicly available information. Levels of traffic are expected to be low.
Noise and Vibration	• Noise and vibration baseline conditions are likely to be as expected for a quiet rural location in most areas, however some noisier areas are within the AoS (inc. St.Peter Port and the airport)
Air Quality	• Air quality baseline information has not been collated to date due to a lack of easily obtainable publicly available information. Air pollution is expected to be very low.
Socio-Economic	• The AoS includes a number of tourism locations, with agriculture also present outside of the urban areas. Urban areas in Guernsey are situated around St. Peters Port and around St. Anne in Alderney.
Health	• Health baseline information has not been collated to date due to a lack of publicly available information.

[6] Environment : Protected Trees, Buildings and Monuments Webmap. (gov.gg)

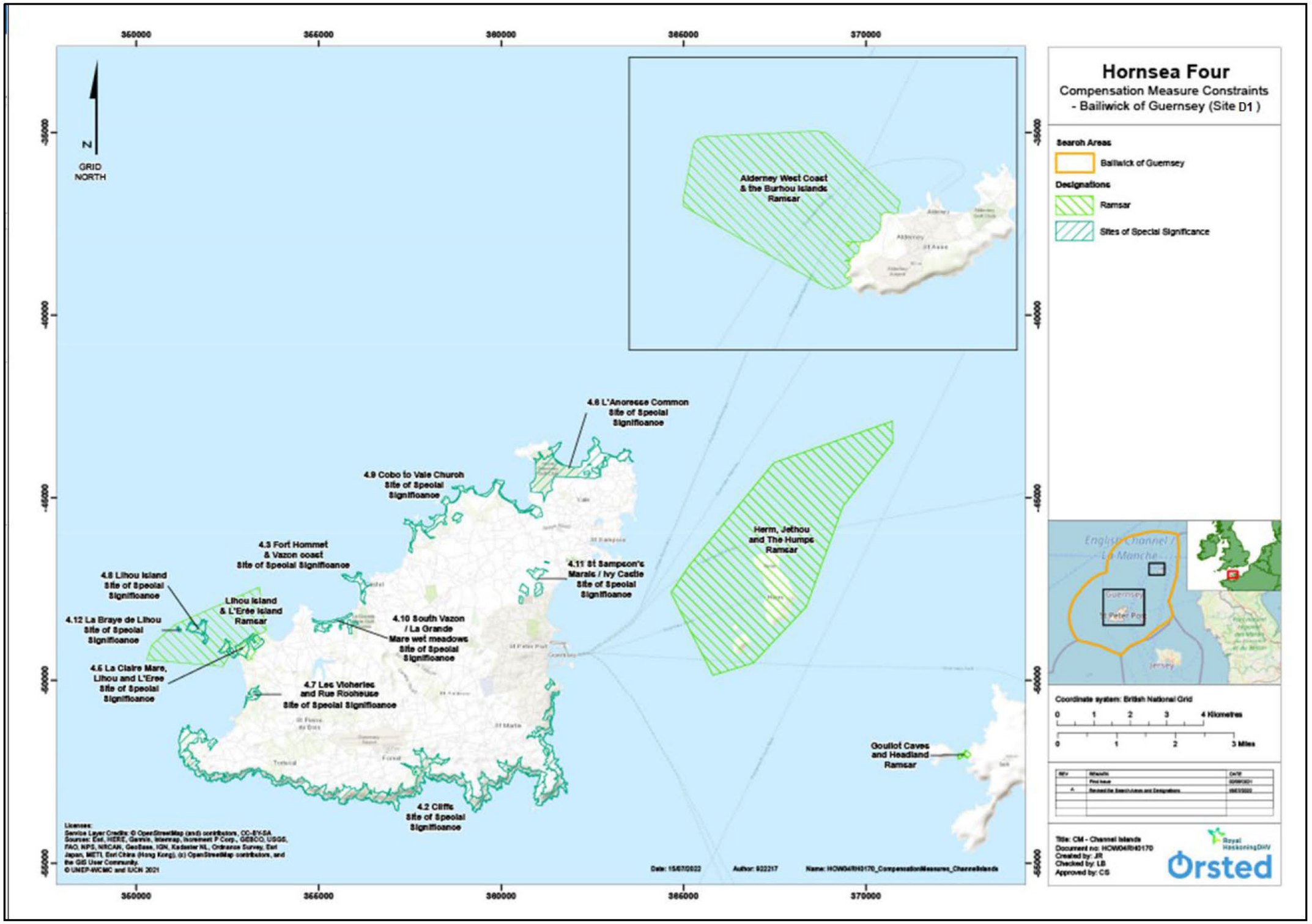


Figure 21: Baseline designation for AoS D1 (Bailiwick of Guernsey).

11.3 Assessment

11.3.1 Identification of Impacts and Scope of Assessment

11.3.1.1 Based on the information presented in A4.6.1: Compensation Project Description (Deadline 7 submission) (and summarised in Section 4.1.8) all activities associated with the construction, operation and decommissioning of the predator eradication Compensation Measure were defined and potential impact pathways identified.

11.3.1.2 All impacts considered to be scoped into the assessment are detailed in A4.6.3: Compensation Impacts Register (Deadline 7 submission). No impacts were scoped out of the assessment.

11.3.2 Impact Assessment

11.3.2.1 A4.6.3: Compensation Impacts Register (Deadline 7 submission) identifies the potential scoped in impacts that could result from the installation/construction, implementation/operation, and decommissioning of the new predator eradication Compensation Measure, relating to each technical topic under consideration in the EIA process. Each of these impacts have been considered, following the process outlined in Section 6, with the MDS defined, magnitude of impact and sensitivity of receptor considered and the level of significance derived by the matrix approach. The Compensation Impacts Register is presented in A4.6.3: Compensation Impacts Register (Deadline 7 submission).

11.3.2.2 No impacts are identified in the 'Predator Eradication' tab of A4.6.3: Compensation Impacts Register (Deadline 7 submission) as having potential for LSE in relation to the installation/construction, implementation/operation, and decommissioning of the Predator Eradication Compensation Measure.

11.4 Summary: Predator Eradication EIA

11.4.1.1 As outlined above, no impacts are identified as having potential for LSE in relation to the installation/construction, implementation/operation, and decommissioning of the predator eradication Compensation Measure. Further assessment is required at a later stage for impacts relating to currently unknown MDS parameters.

12 EIA – Resilience Measure – Fish Habitat Enhancement (Seagrass)

12.1 Introduction

12.1.1.1 This section considers the potential impacts arising from the resilience measure – fish habitat enhancement (seagrass). A regional environmental characterisation of the physical, biological and human environmental baseline is presented alongside the results of an assessment of potential significant effects arising from the proposed Resilience Measure. One AoS has been identified for the resilience measure fish habitat enhancement (seagrass) i.e. E1 – Humber Estuary.

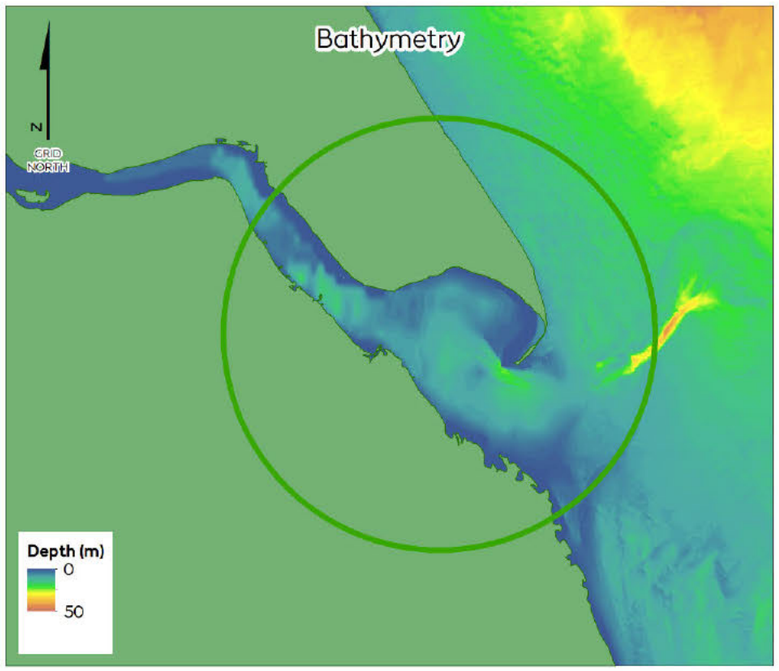
12.2 Baseline

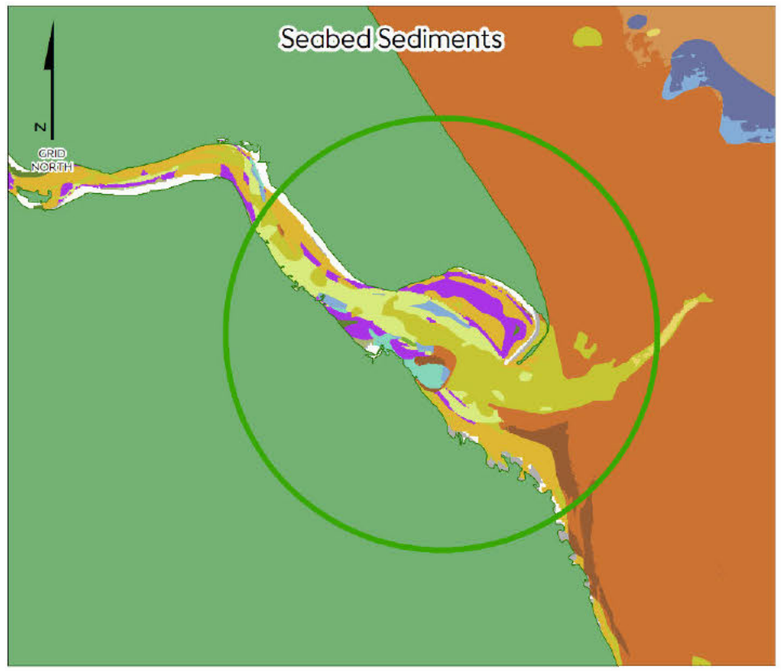
12.2.1.1 Table 11 provides a summary of the baseline environment for the AoS.

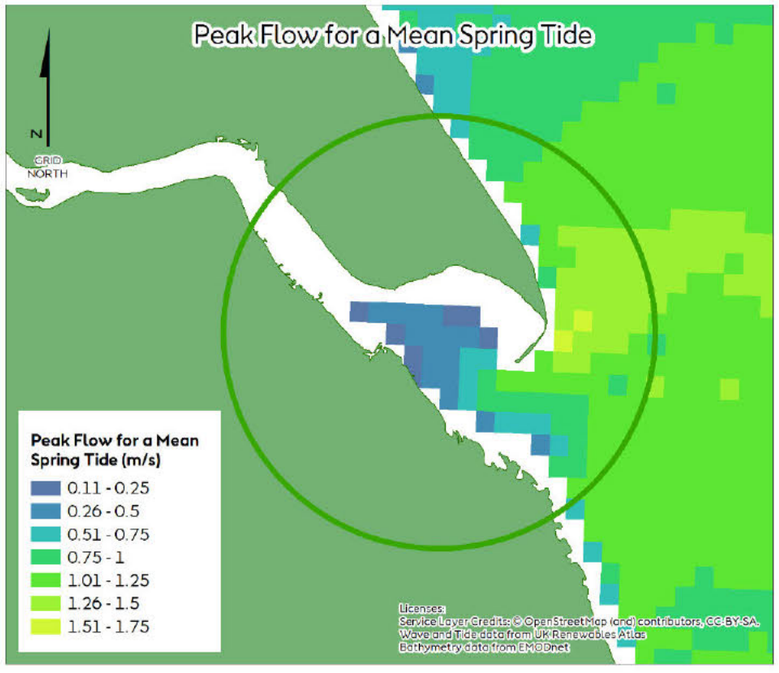
Table 11: Summary of baseline environment in relation to the Area of Search E1 (Humber Estuary) for resilience measure - fish habitat enhancement (seagrass).

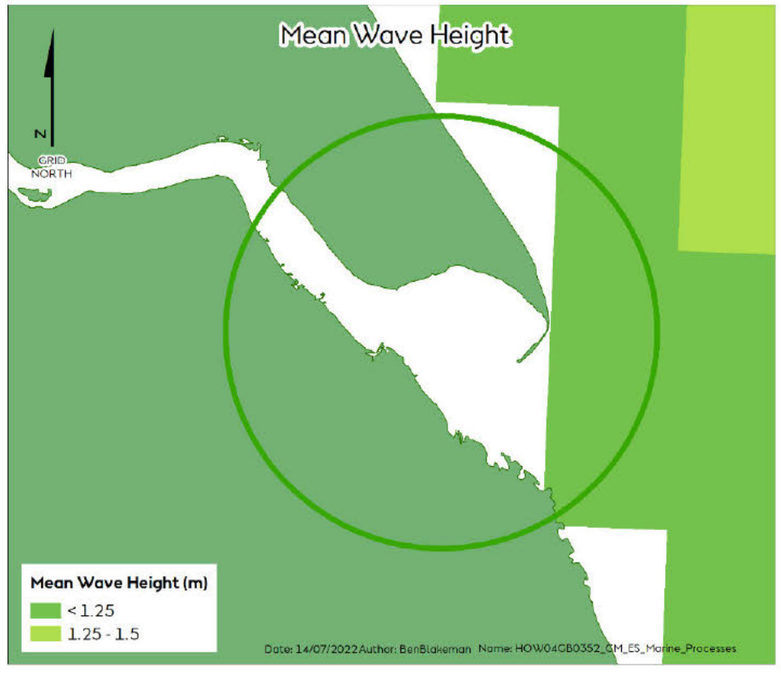
Topic	Summary of Baseline Environment
Marine Geology, Oceanography and Physical Processes	The baseline environment for physical processes is illustrated in **Figure 22**. • The AoS coastline is dominated by Spurn Head, a dynamic 5.5 km sand and gravel spit at the mouth of the Humber and the position of which is controlled by a deep water channel in the estuary mouth (HADA, 2012). Spurn Head provides protection for the extensive mudflats within the Humber Estuary. The Outer Humber Estuary is characterised by mudflats, saltmarshes and beach areas (Scott Wilson, 2010). • Surficial seabed sediments are dominated by sandy gravels outwith the mouth of the Humber Estuary (DECC, 2016a), whilst within the estuary, muds and silts predominate (Scott Wilson, 2010). • Generally, the direction of sediment transport is into the Humber Estuary along the coast and outwards within the channels, although localised pathways and circulatory systems occur in the estuary mouth (HADA, 2012). Suspended sediments are typically high in this region and characterised by the presence of the Humber Plume (E.On, 2009)
Benthic and Intertidal Ecology	The baseline environment for benthic ecology is illustrated in **Figure 23**. • In the Humber Estuary they include gravels and sands, muddy sands and mud, which reflects varying degrees of exposure to waves, currents and inflowing rivers. Substantial areas of mud and sandflat have been lost due to land claim but are still a major component of the Humber Estuary and represent 4.5% of the UK's total mud and sandflat resource. • There are approximately 630 Ha of saltmarsh on the Humber, accounting for only 2% of the estuarine area due to large historical losses from land claim. • The subtidal environment of the Humber Estuary is highly dynamic and varies according to the composition of the bottom sediments, salinity, sediment load and turbidity, dissolved oxygen and anthropogenic factors relating to water quality and dredging. • The Humber Estuary is designated as an SAC.
Fish and Shellfish Ecology	The baseline environment for fish and shellfish ecology is illustrated in **Figure 24**. • The Humber supports a fish assemblages characteristic of the southern North Sea macro-tidal estuary. Shellfish populations are also typical of the estuary typology with commercial interest focusing on: large decapod crustaceans (brown shrimp, *Crangon sp.*; lobster, *Homarus gammarus*; and brown crab, *Cancer pagurus*), bivalve molluscs (cockles, *Cerastoderma edule*; mussels, *Mytilus sp.*) and whelk (*Buccinum undatum*) (PINS, 2011). • This AoS has two Annex II fish species being the sea lamprey (*Petromyzon marinus*) and the river lamprey (*Lampetra fluviatilis*) which both breed in the River Derwent (JNCC, 2021).
Marine Mammals	The baseline environment for marine mammals is illustrated in **Figure 25**. • The most common marine mammals within the Thames Estuary area include harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), harbour seal (*Phoca vitulina*), and grey seal (*Halichoerus grypus*) (Hammond et al. 2017).
Offshore and Intertidal Ornithology	The baseline environment for offshore ornithology is illustrated in **Figure 26**.

Topic	Summary of Baseline Environment
	• The Humber Estuary plays an international role in bird migration and is one of the most important wetland sites in the UK. The region provides a safe feeding and roosting area for species moving from breeding sites in the Arctic and sub-Arctic to wintering grounds in southern Europe and Africa, as well as for species which use the Humber as an overwintering site (Humber Nature, 2021). • Within the AoS there are two SPAs with offshore ornithology designated features, the Humber Estuary SPA and the Greater Wash SPA. The litter tern (*Sterna albifrons*) is the only species present at both sites, with the Humber Estuary SPA designated for an additional 37 species, and the Greater Wash SPA designated for an additional five species.
Commercial Fisheries	The baseline environment for commercial fisheries is illustrated in **Figure 27.** • Commercial fish species or those with recreational angling relevance that are routinely recorded in the Humber include: whiting (*Merlangius merlangus*), sprat (*Sprattus sprattus*), common (or Dover) sole (*Solea solea*) and flounder (Platichthys flesus). Less common but still relevant are cod (*Gadus morhua),* saithe (*Pollachius virens*), pollack (*Pollachius pollachius*), dab (*Limanda limanda*), plaice (*Pleuronectes platessa*) and eel (*Anguilla anguilla*) (PINS, 2011). • As shown on **Figure 27**, the key methods of fishing in the AoS are beam trawling, potting and trapping.
Shipping and Navigation	The baseline environment for shipping and navigation is illustrated in **Figure 28**. • The Humber Estuary is one of the most important estuaries in the UK for commerce, with an expanding port complex and extensive bank-side industries. The four main ports on the estuary (Grimsby, Hull, Immingham and Goole) are operated by Associated British Ports. • Outside the Humer Estuary within the AoS, traffic is managed through a traffic separation scheme.
Marine Archaeology	The baseline environment for marine archaeology is illustrated in **Figure 28**. • Within the AoS, there are many different types of archaeological features including both ship and aircraft wrecks. The Humber region has a long and busy maritime history, but the seas here can be hazardous.









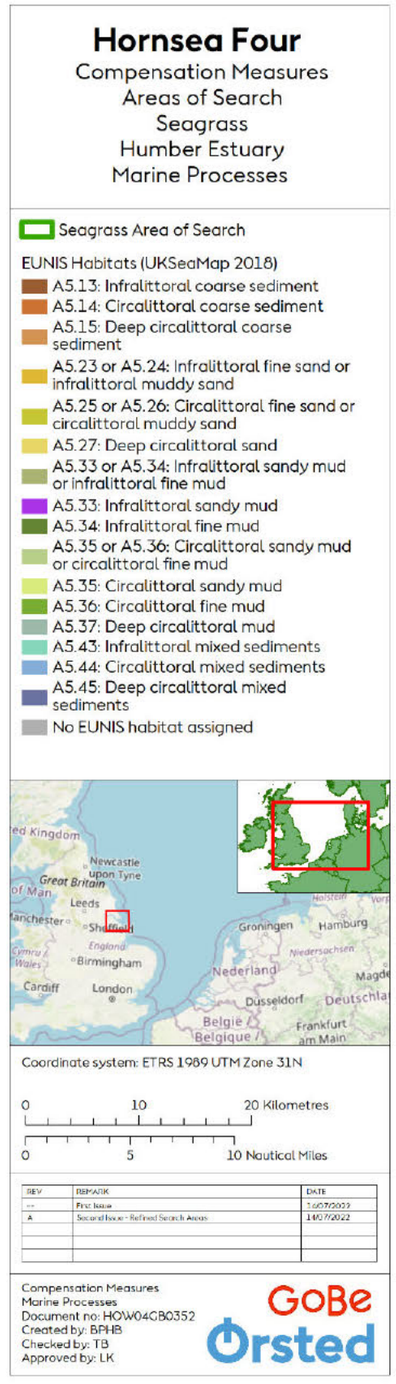


Figure 22: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Marine Processes.

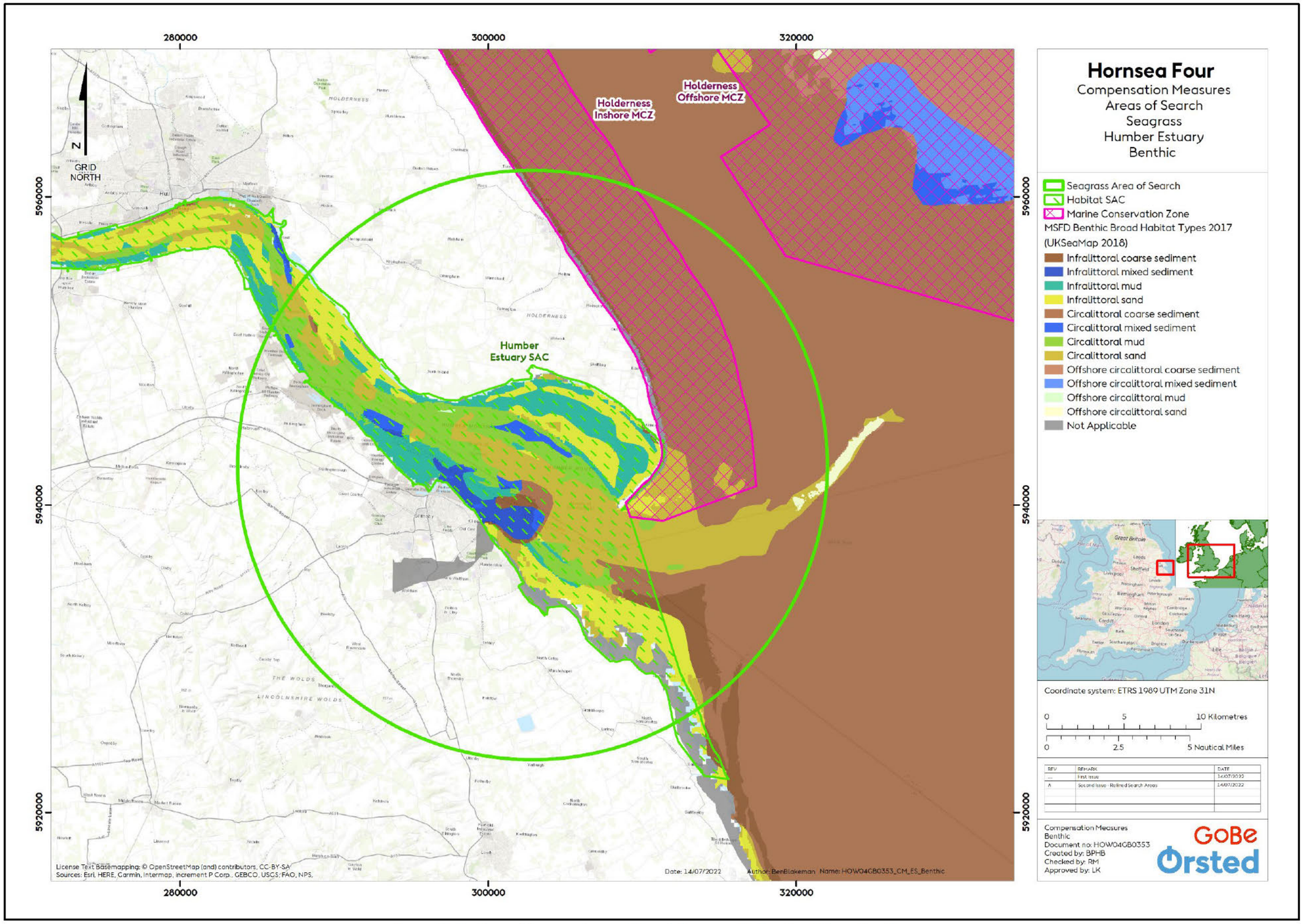


Figure 23: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Benthic.

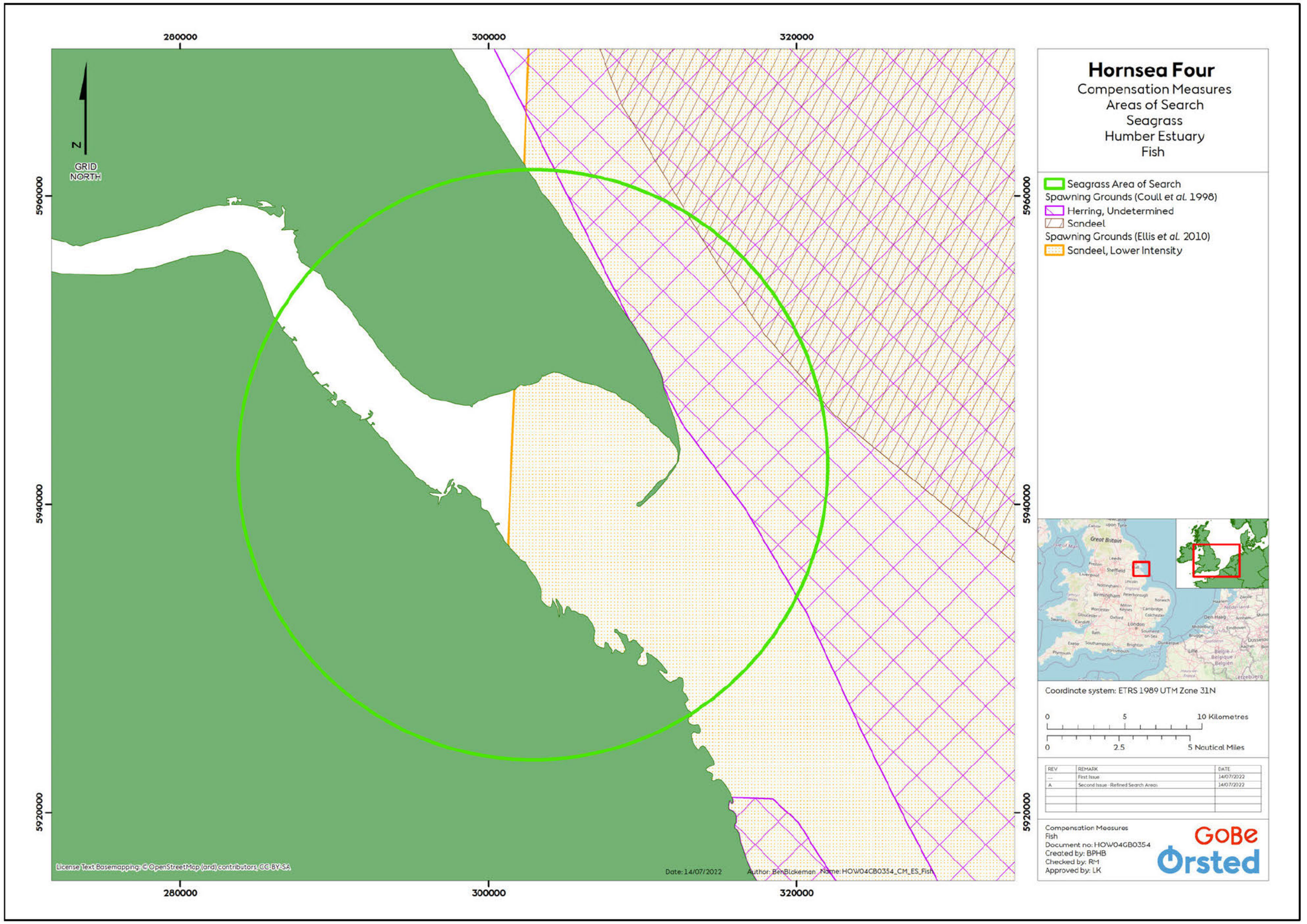
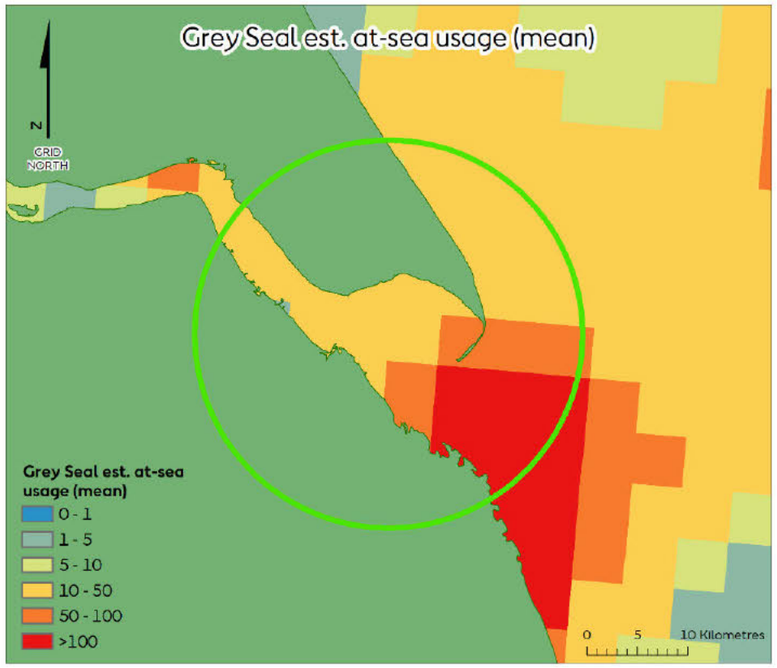
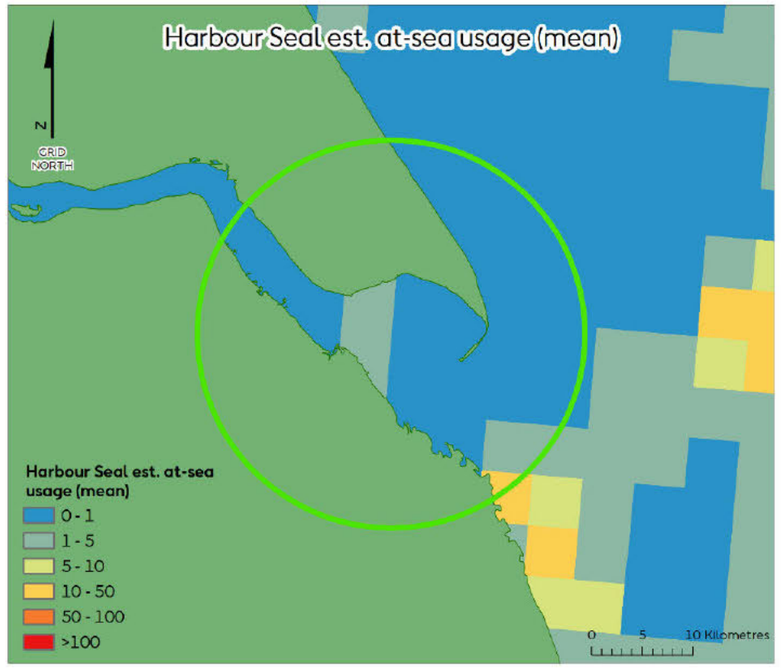
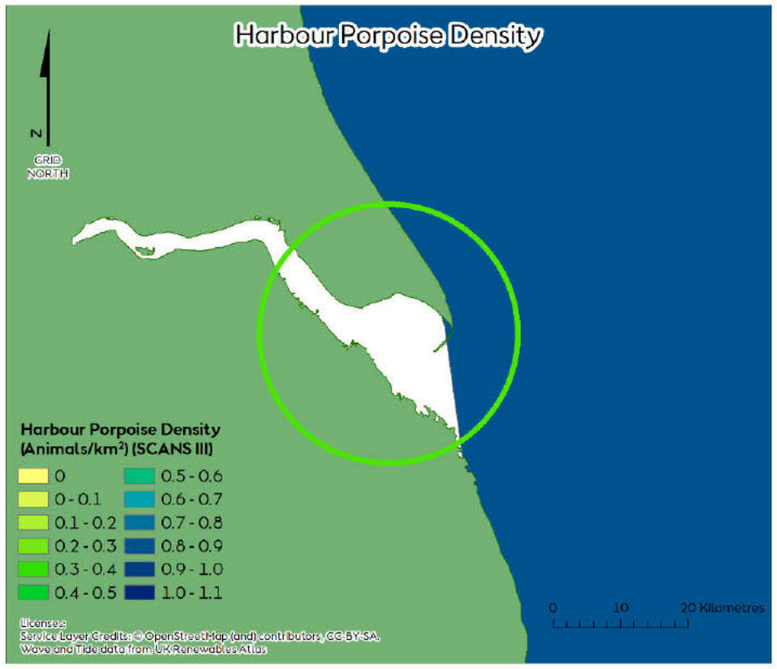
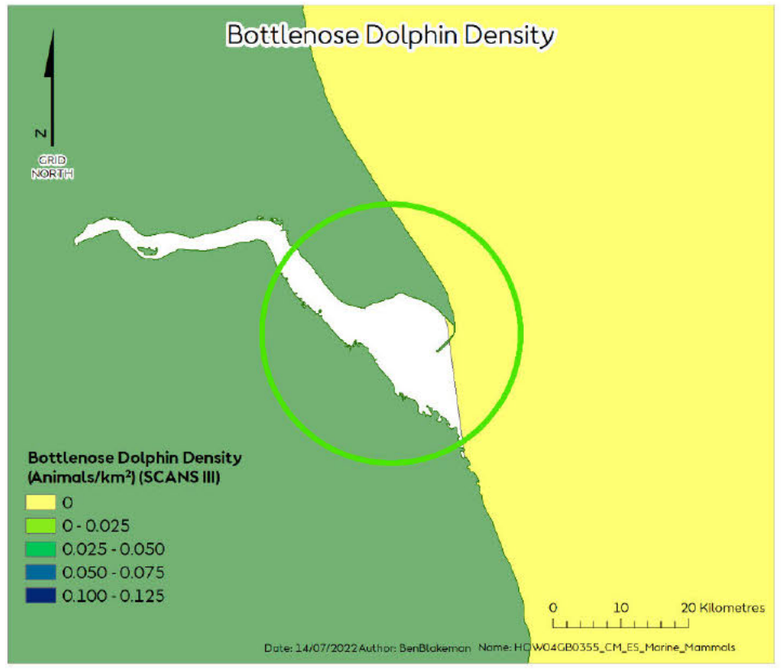


Figure 24: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Fish.









Hornsea Four
Compensation Measures
Areas of Search
Seagrass
Humber Estuary
Marine Mammals

Seagrass Area of Search

Estimated at-sea Distribution of Grey and Harbour Seals maps data from Sea Mammal Research Unit (SMRU) and Marine Scotland, 2017

Coordinate system: ETRS 1989 UTM Zone 31N

REV	REMARK	DATE
—	First Issue	14/07/2022
A	Second Issue - Refined Search Areas	14/07/2022

Compensation Measures
Marine Mammals
Document no: HOW04GB0355
Created by: BPHB
Checked by: TB
Approved by: LK

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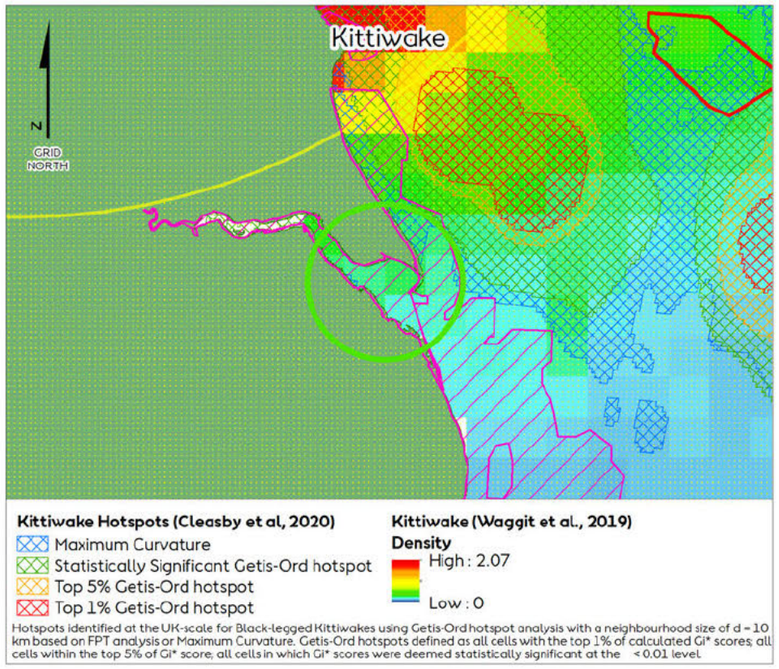
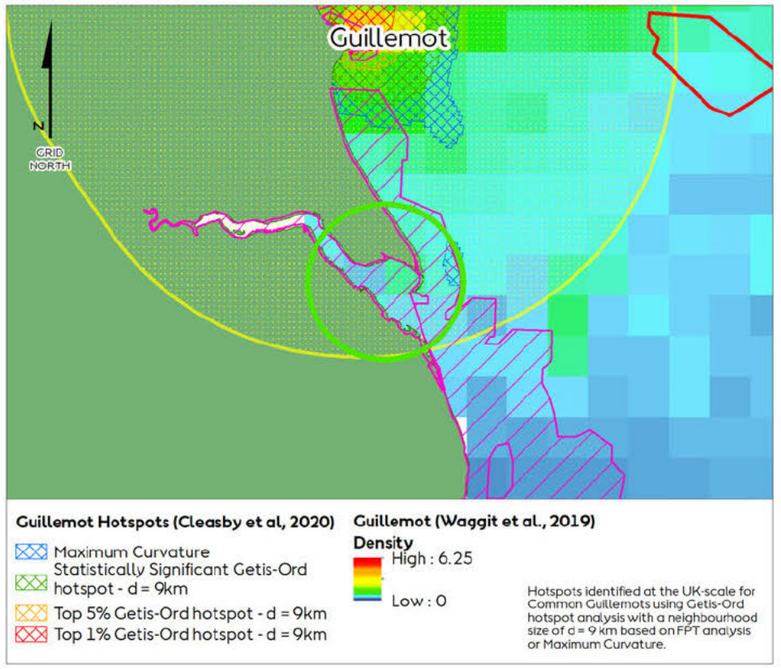
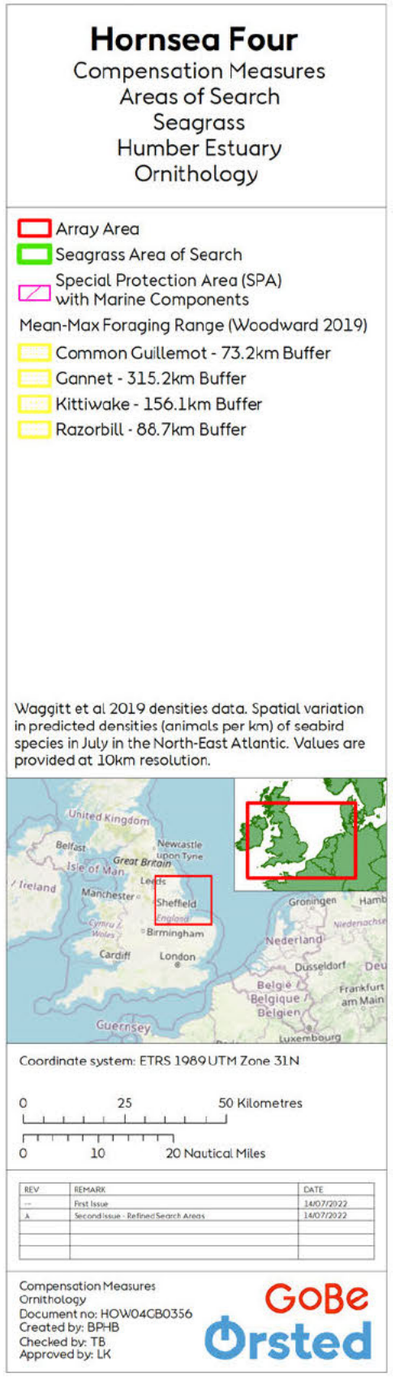
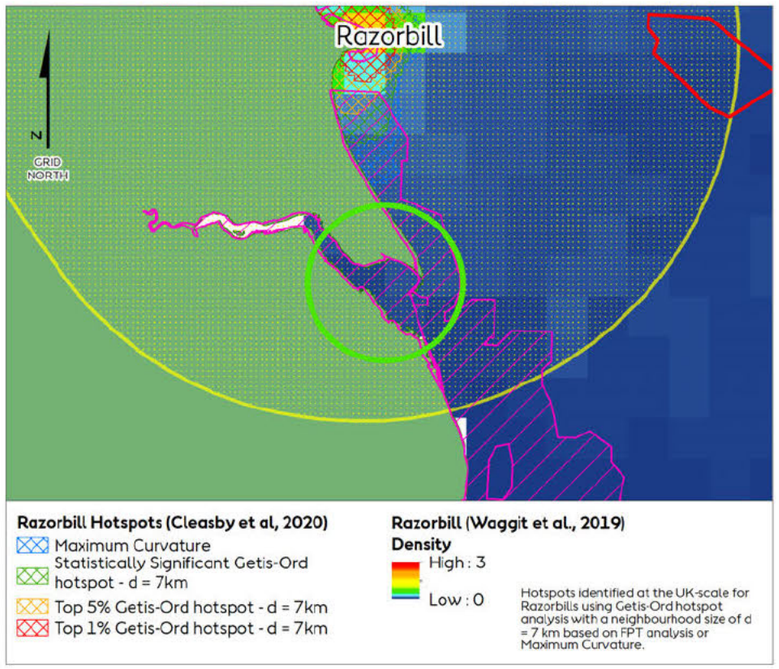
Figure 25: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Marine Mammals.









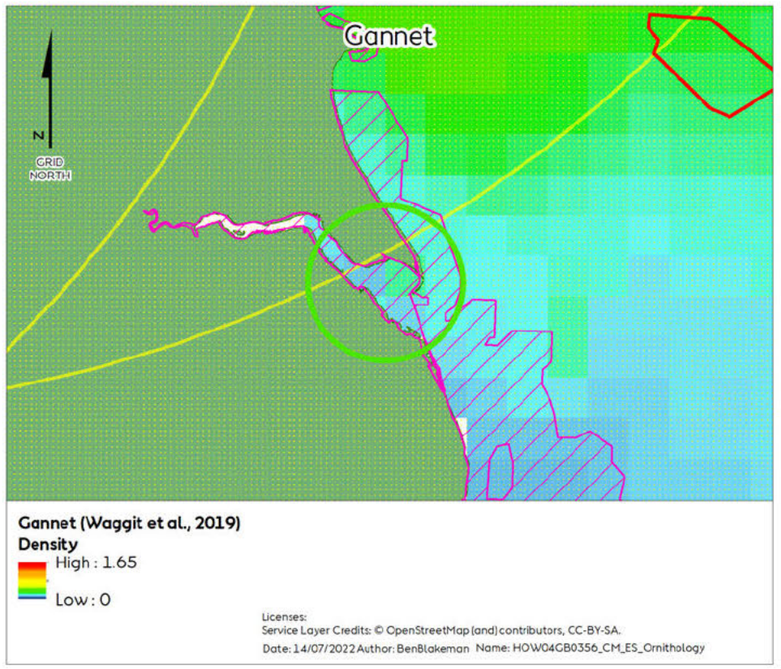
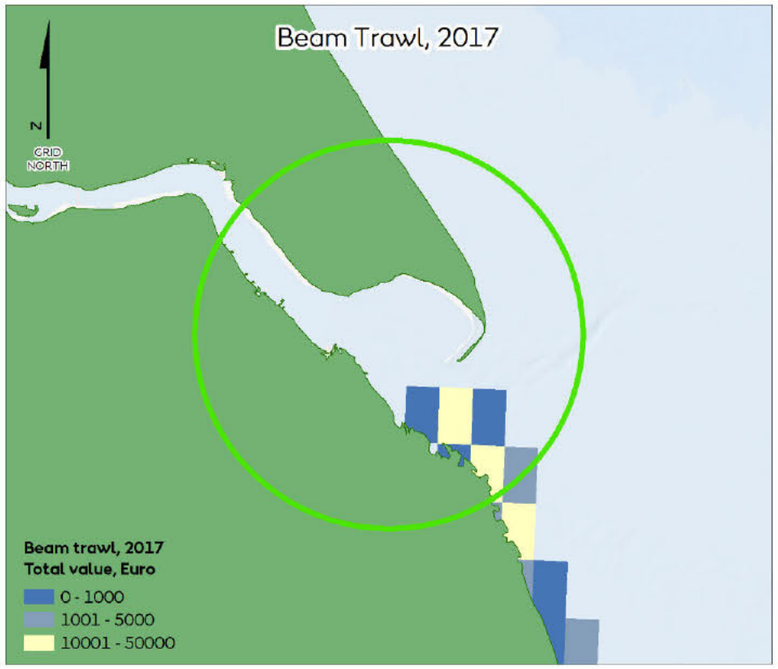
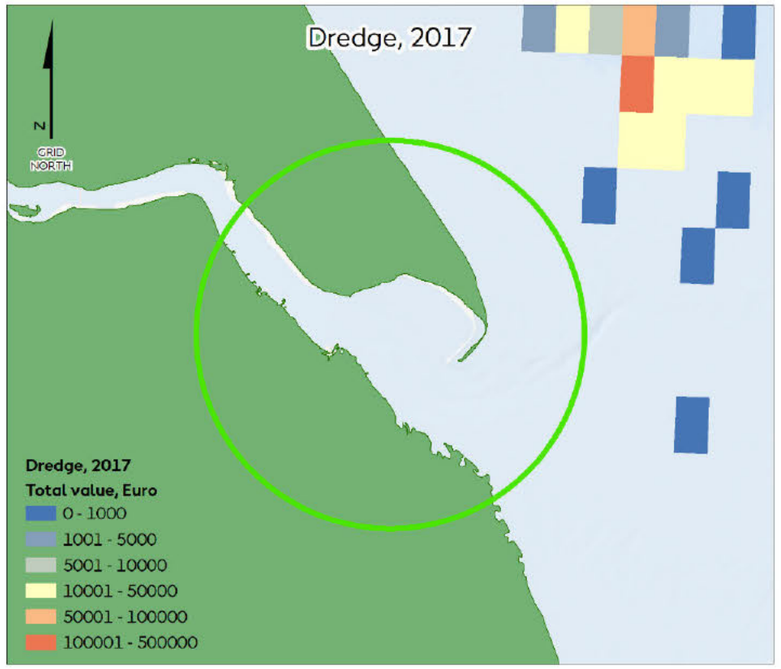
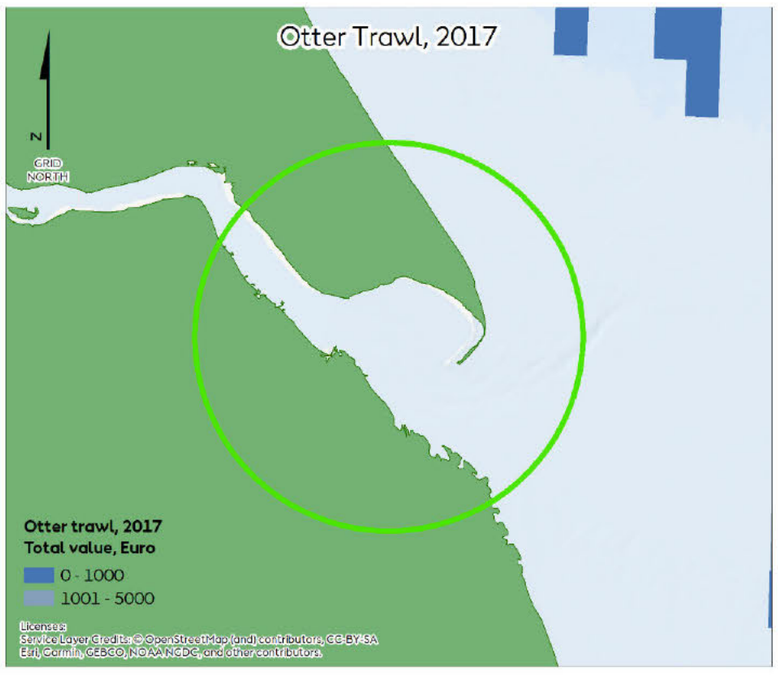


Figure 26: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Ornithology.







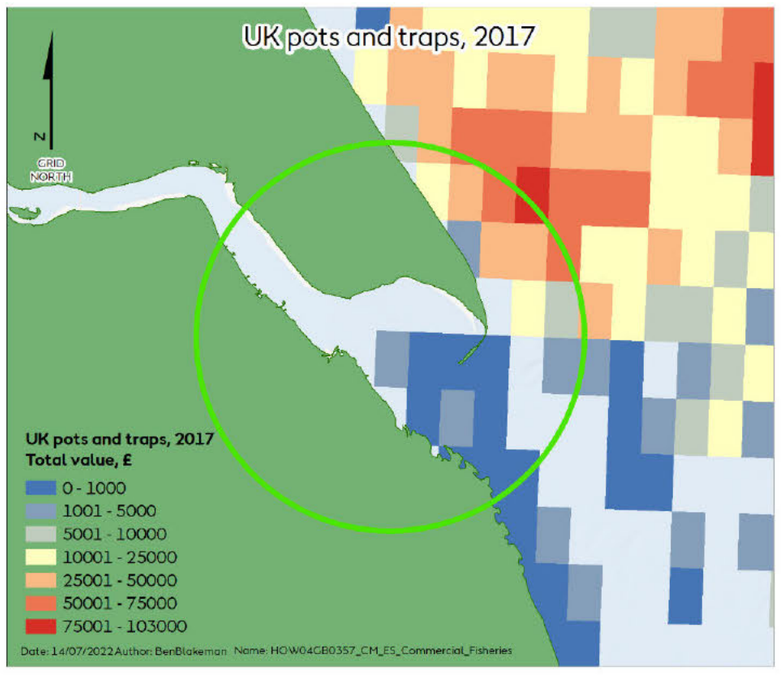


Figure 27: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Commercial Fisheries.

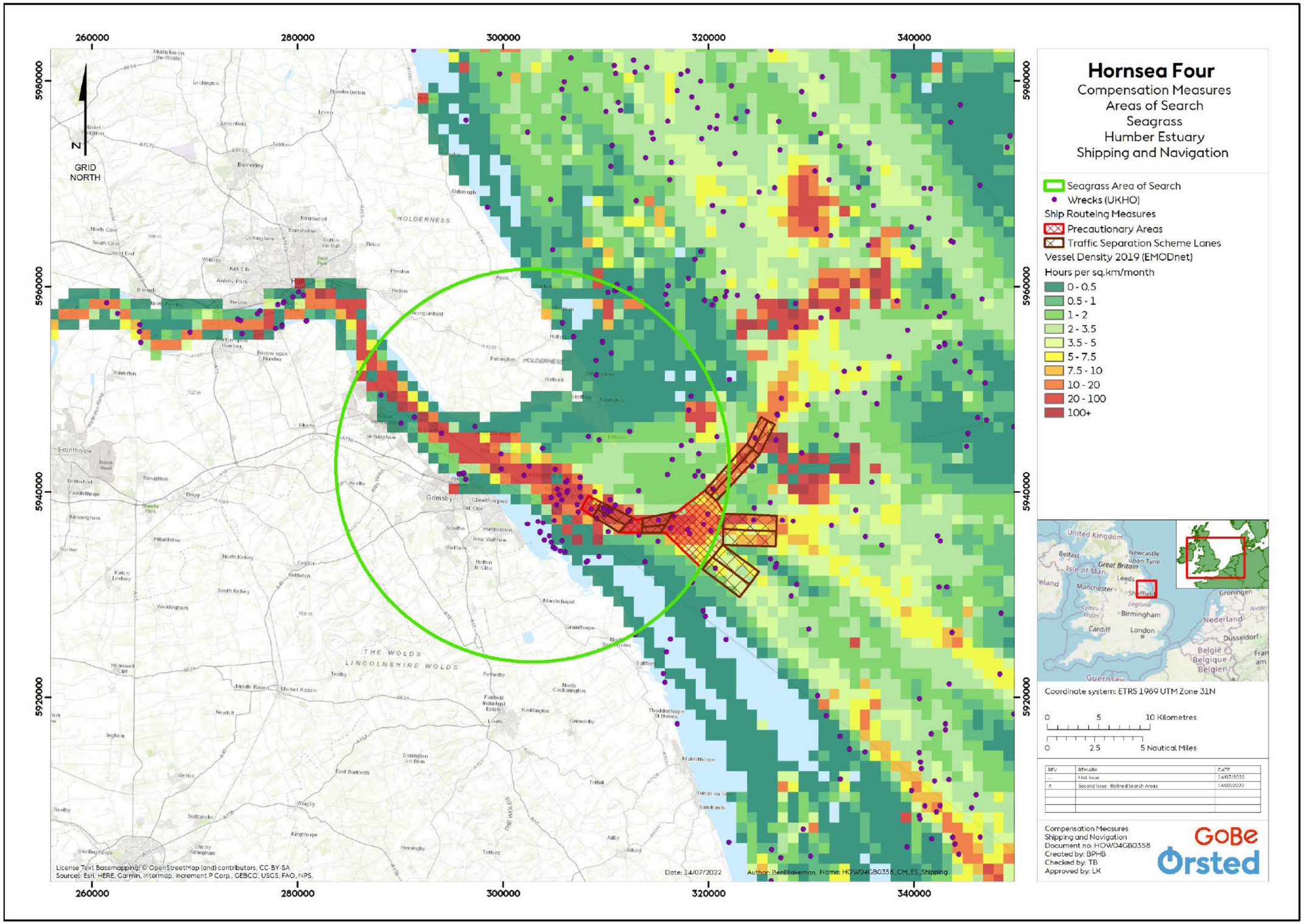


Figure 28: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Shipping and Navigation.

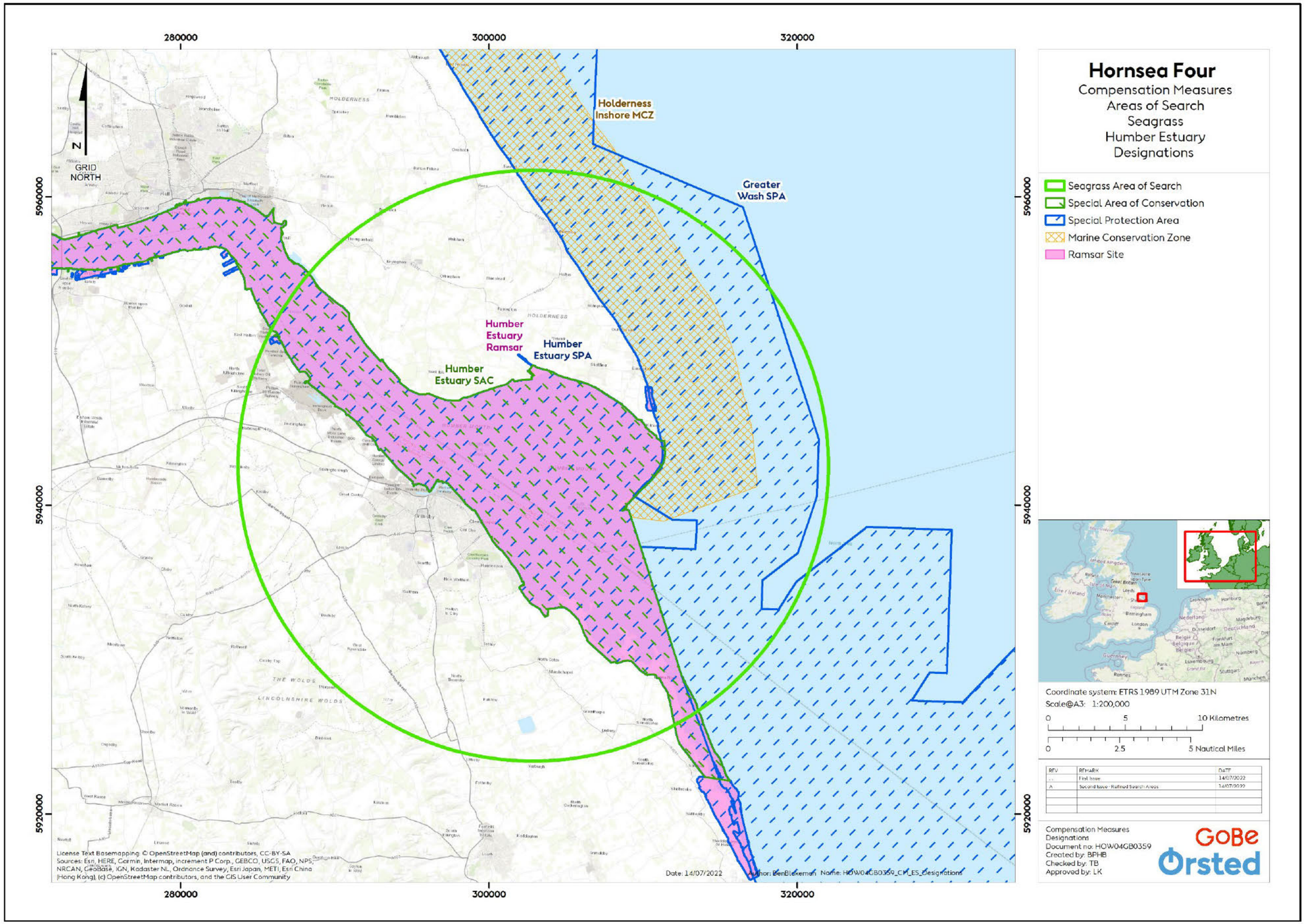


Figure 29: Resilience Measures Areas of Search Seagrass E1: Humber Estuary Designations.

12.3 Assessment

12.3.1 Identification of Impacts and Scope of Assessment

12.3.1.1 Based on the information presented in **A4.6.1: Compensation Project Description** (Deadline 7 submission) (and detailed in **Section 4.1.9**), all activities associated with the construction, implementation/O&M, and decommissioning of the resilience measure – fish habitat enhancement (seagrass) Compensation Measure were defined and potential impact pathways identified.

12.3.1.2 **Table 12** details the impacts that were scoped out of the assessment at this stage alongside justification as to why each impact was scoped out.

12.3.1.3 All impacts considered to be scoped into the assessment are detailed in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

Table 12: Resilience Measure – Fish Habitat Enhancement (Seagrass) – Impacts Scoped Out of Assessment.

EIA Topic	Phase	Potential Impact	Justification for Scoping Out
Benthic and Intertidal Ecology Fish and Shellfish Ecology Marine Mammals Offshore and Intertidal Ornithology	Installation/ Construction Implementation/ O&M	Accidental release of pollutants (e.g. from accidental spillage/leakage) and resulting in potential effects on receptors.	The magnitude of an accidental spill incident will be limited by the size of chemical or oil inventory on construction vessels. In addition, released hydrocarbons would be subject to rapid dilution, weathering and dispersion and would be unlikely to persist in the marine environment. The likelihood of an incident will be reduced by implementation of a Project Environmental Management and Monitoring Plan (PEMMP), undertaken in accordance with CoC-OFF-7 (**A4.6.4: Compensation Commitments Register** (Deadline 7 submission)). This impact has therefore been scoped out of the assessment.
Benthic and Intertidal Ecology Fish and Shellfish Ecology	Installation/ Construction Implementation/ O&M	Seabed disturbances leading to the release of sediment contaminants and resulting in potential effects on receptors.	Following any seabed disturbances, the majority of resuspended sediments are expected to be deposited within the immediate vicinity of the works. The release of any potential contaminants that may be present within the small proportion of fine sediments is likely to be rapidly dispersed with the tide and/or currents therefore increased bioavailability resulting in adverse eco-toxicological effects are not expected. As such and combined with the limited extent and duration of any seabed disturbances, the impact has been scoped out of the assessment.
All EIA Topics	Decommissioning	All potential impacts.	It is currently anticipated that the implementation of the resilience measure – fish habitat enhancement (seagrass) Compensation Measure will result in new management practices which shall continue for the lifetime of Hornsea Four. The Compensation Measure sites will be left in perpetuity and as such, all decommissioning impacts have been scoped out of the assessment.
Aviation and Radar	Installation/ Construction Implementation/ O&M	All potential impacts.	Due to the lack of impact pathway, all potential aviation and radar impacts are scoped out.
Seascape, Landscape and Visual Resources	Installation/ Construction Implementation/ O&M	All potential impacts.	Due to the lack of impact pathway, all potential seascape, landscape and visual resources impacts are scoped out.

EIA Topic	Phase	Potential Impact	Justification for Scoping Out
Infrastructure and Other Users	All Phases	All potential impacts on aggregate dredging activities, disposal sites, Carbon Capture and Storage (CCS) sites, cables and pipelines, Oil & Gas (O&G) activities.	The resilience measure – fish habitat enhancement (seagrass) Compensation Measure will not be implemented in immediate proximity to aggregate dredging activities, disposal sites, CCS sites, cables and pipelines, and Oil & Gas (O&G) activities as per CoC-OFF-13. As such, all potential impacts on these receptors have been scoped out of the assessment.

12.3.2 Impact Assessment

12.3.2.1 **A4.6.3: Compensation Impacts Register** (Deadline 7 submission) identifies the potential scoped in impacts that could result from the installation/construction, implementation/O&M, and decommissioning of the resilience measure – fish habitat enhancement (seagrass), relating to each technical topic under consideration in the EIA process. Each of these impacts have been considered, following the process outlined in **Section 6**, with the MDS defined, magnitude of impact and sensitivity of receptor considered and the level of significance derived by the matrix approach. The Compensation Impacts Register is presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

12.3.2.2 As presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission), it has been concluded that found that no LSE is predicted for any of the potential impacts arising from the installation/construction, implementation/O&M and decommissioning of the resilience measure – fish habitat enhancement (seagrass). As such, the potential effects to all receptors are therefore **not significant** in terms of the EIA Regulations (**A1.5: Environmental Impact Assessment Methodology (APP-011)**).

13 Conclusions

13.1.1.1 The Hornsea Four Compensation Measures EIA has considered the environmental impacts associated with the implementation of the following proposed Compensation Measures:

- New offshore nesting platform;
- Repurposed offshore nesting platform;
- New onshore nesting platform;
- Bycatch reduction technologies;
- Predator eradication; and
- Resilience Measure – Fish Habitat Enhancement (Seagrass).

13.1.1.2 Each measure is described in terms of the AoS (where the measures could be located), how the measure would be implemented, managed and (where relevant) decommissioned. For each Compensation Measure, the potential impacts has been considered, following the process outlined in **Section 6**, with some impacts scoped out and others taken forward for assessment, with the MDS defined, magnitude of impact and sensitivity of receptor considered and the level of significance derived by the matrix approach. The Compensation Impacts Register is presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission).

13.1.1.3 As presented in **A4.6.3: Compensation Impacts Register** (Deadline 7 submission), for all Compensation Measures, it has been concluded that found that no LSE is predicted for any of the potential impacts arising from the installation/construction, implementation/O&M and decommissioning of the Compensation Measures. As such, the potential effects to all receptors are therefore **not significant** in terms of the EIA Regulations (**A1.5: Environmental Impact Assessment Methodology (APP-011)**).

13.1.1.4 The assessment provided in this document is based on the current understanding of the location, scope and nature of the proposed Compensation Measures. It should be noted, however, that ultimately, the Compensation Measures will not be consented through the Hornsea Four DCO application process and will be subject to (where necessary) standalone EIA and HRA processes as part of their own consenting process (for example a Marine Licence application and/or Planning Application). As part of that consenting process, further assessment work will be undertaken, based on refined design and methodology details.

14 References

ABPmer, 2015. Environmental Statement for Port of Southampton: Southampton Approach Channel Dredge Updated by Further Information. Available online: [redacted]

ABPmer et al., 2011. Renewables Atlas. [redacted]

Bell, E., Boyle, D., Floyd, K., Garner-Richards, P., Swann, B., Luxmoore, R., Patterson, A., and Thomas, R. 2011. 'The groundbased eradication of Norway rats (Rattus norvegicus) from the Isle of Canna, Inner Hebrides, Scotland'. In: C.R. Veitch, M.N. Clout and D.R. Towns (eds.) Island invasives: eradication and management, pp. 269 –274. Occassional Paper SSC no. 42. Gland, Switzerland: IUCN and Auckland, New Zealand: CBB.

Cefas, 2021. Fisheries Sensitivity Maps in British Waters. [redacted] Accessed on 22 August 2021.

DECC, 2016a. Offshore Energy SEA 3: Appendix 1B Geology, Substrates and Coastal Processes.

DECC, 2016b. Offshore Energy SEA 3: Appendix 1D: Water Environment.

Duck, C. D. 1998. Chapter 5.14 Seals. In: Coasts and Seas of the United Kingdom. Region 7. Southeast England: Lowestoft to Dungeness: 148-149. Peterborough. Joint Nature Conservation Committee. (Coastal Directories Series).

EMODnet, 2021. European Marine Observation and Data Network Map Viewer. Available online: [redacted]

E.On, 2009. Humber Gateway Offshore Wind Farm: Offshore ES. Description of the Physical Baseline Environment. [redacted]

FishTek. 2021. Netlight patented technology, low cost net illumination for reduced bycatch. Available online: [redacted]

Futurecoast (DEFRA, 2002; Environment Agency, 2018). [redacted]

Global Fishing Watch. 2021. Global Fishing Activity Map. Available online: [redacted]

Goodwin, C., Edwards H., Breen, J. and Picton, B., 2011. Rathlin Island - A Survey Report from the Nationally Important Marine Features Project 2009-2011. Northern Ireland Environment Agency Research and Development Series No. 11/03.

Halcrow, 2010. Shoreline Management Plan SMP2: Durlston Head to Rame Head. Appendix C: Baseline Process Understanding.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Tielmann, J., Vingada, J. and Øien, N. 2017. Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III Aerial and shipboard surveys. Available online:

Humber Nature, 2021. Humber Management Scheme, Protected Habitats and Species. Accessed on 24 August 2021.

Humber Aggregate Dredging Association (HADA), 2012. Marine aggregate regional environmental assessment of the Humber and Outer Wash.

IEMA, (2004) Guidelines for Environmental Impact Assessment, IEMA Lincoln.

Joint Nature Conservation Committee (JNCC), 2021. Humber Estuary, Designated SAC. https://sac.jncc.gov.uk/site/UK0030170. Accessed On 26 August 2021.

Joint Nature Conservation Committee (JNCC), 2020. Natura 200 – Standard Data Form, Solent and Dorset Coast Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020330.pdf

Joint Nature Conservation Committee (JNCC), 2017a. Natura 2000 – Standard Data Form, Falmouth Bay to St Austell Bay Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020323.pdf

Joint Nature Conservation Committee (JNCC), 2017b. Natura 200 – Standard Data Form, Falmouth Bay to St Austell Bay Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020323.pdf

Joint Nature Conservation Committee (JNCC), 2015a. Natura 200 – Standard Data Form, Chichester and Langstone Harbours Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9011011.pdf

Joint Nature Conservation Committee (JNCC), 2015b. Natura 200 – Standard Data Form, Grassholm Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9014041.pdf

Joint Nature Conservation Committee (JNCC), 2015c. Natura 200 – Standard Data Form, Portsmouth Harbour Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9011051.pdf

Joint Nature Conservation Committee (JNCC), 2015d. Natura 200 – Standard Data Form, Solent and Southampton Water Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9011061.pdf

Joint Nature Conservation Committee (JNCC), 2015e. Natura 200 – Standard Data Form Tamar Estuaries Complex Special Protection Area. Available online: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9010141.pdf

Marine Aggregate Levy Sustainability Fund (MALSF). 2009. Outer Thames Estuary Regional Environmental Characterisation. Available online:

Marine Traffic. 2021. Available online:

McGoran, A.R., Cowie, P,R., Clark, P.F., McEvoy, J.P. and Morritt, D. 2018. Ingestion of plastic by fish: A comparison of Thames Estuary and Firth of Clyde populations. Marine Pollution Bulletin 137: 12-23. Available online:

Miles, J., Parsons, M. and O'Brien, S. 2020. Preliminary assessment of seabird population response to potential bycatch mitigation in the UK-registered fishing fleet. Report prepared for the Department for Environment Food and Rural Affairs (Project Code ME6024).

Nathan, H.W., Clout, M.N., MacKay, J.W., Murphy, E.C. & Russell, J.C. 2015. Experimental island invasion of house mice. Population Ecology, 57, 363-371.

Ozer, J. and Legrand. S. (BEAWARE II: Review of the physical oceanography in the area of the Bonn Agreement. RBINS/OD Nature/ MUMM. Available online:

Planning Inspectorate (PINS), 2011. Ch 12 ES Commercial Fisheries 20110919. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030001/TR030001-000317-12%20-%20Commercial%20Fisheries.pdf. Accesses on 26 August 2021.

Port of London Authority, 2021a. The Thames Estuary. Available online: Accessed on 23 August 2021

Port of London Authority, 2021b. PLA Radar Network. Available online: . Accessed on 23 August 2021.

Richardson, M. and Soloviev, M., 2021. The Thames: Arresting Ecosystem Decline and Building Back Better. Sustainability 2021, 13, 6045.

Royal Haskoning, 2011. Cornwall and Isles of Scilly SMP2: Review of Coastal Processes and Geomorphology.

SCOS, 2007. Scientific advice on matters related to the management of seal populations: 2007. Special Committee on Seals, 93pp.

SCOS, 2020. Scientific advice on matters related to the management of seal populations: 2020. Special Committee on Seals, 122pp.

The Independent. 2021. Science news in brief: From googly eye birds to flat pasta turning 3D. Available online: [redacted]

Wilson, S., 2010. Flamborough Head to Gibraltar Point Shoreline Management Plan. For Humber Estuary Coastal Authorities Group.