Hornsea 4

Ørsted



Environmental Impact Assessment: Scoping Report

Prepared	ERM and GoBe
Checked	David King and Lily Crompton
Accepted	Julian Carolan
Approved	Stuart Livesey
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Glossary

AADT	Annual Average Daily Traffic
AC	Alternating Current
ACC	Area Control Centre
AD	Air Defence
ADR	Air Defence Radar
ADS	Archaeology Data Service
AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
AGDS	Acoustic Ground Discrimination System
AIAA	Areas of Intense Aerial Activity
AIS	Automatic Identification System
AIS	Aeronautical Information Service
ALC	Agricultural Land Classification
amsl	Above mean sea level
AOC	Aircraft Operator Certificate
AQMA	Air Quality Management Area
ARA	Airborne Radar Approach
ARP	Airfield Reference Point
ATC	Air Traffic Control
ATS	Air Traffic Services
AURN	Automatic Urban and Rural Network
BAP	Biodiversity Action Plan
BEIS	Business, Energy and Industrial Strategy
BGS	British Geological Survey
BHCT	Broad Historic Character Types
BODC	British Oceanographic Data Centre
BP	Before Present ('present' read as 1950)
BRAG	Black, Red, Amber, Green
BTO	British Trust for Ornithology
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CCME	Canadian Council of Ministers of the Environment
CCS	Carbon Capture and Storage
CD	Chart Datum
CEMP	Construction Environmental Management Plan
CGOC	Coastguard Operations Centre
CI	Confidence Interval
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CNS	Communication Navigation Surveillance
CoCP	Code of Construction Practice
CODA	Cetacean Offshore Distribution and Abundance in the European Atlantic
CPA	Coastal Protection Area

CPA	Coastal Protection Act
CPA	Closest Point of Approach
CRC	Control and Reporting Centre
CSM	Conceptual Site Model
CTA	Control Area
DBEIS	Department of Business, Energy and Industrial Strategy
DBERR	Department of Business, Enterprise and Regulatory Reform
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DFDS	Det Forenede Dampskibs-Selskab
DGC	Defence Geographic Centre
DIO	Defence Infrastructure Organisation
dML	Deemed Marine Licence
DMRB	Design Manual for Roads and Bridges
DOC	Documented Operational Coverage
DTI	Department of Trade and Industry
EA	Environment Agency
ECC	Export Cable Corridor
EcIA	Ecological Impact Assessment
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EISA	Electrical Infrastructure Study Area
EMF	Electromagnetic Fields
EMMP	Environmental Management and Monitoring Plan
EMODnet	The European Marine Observation and Data Network
ERCOP	Emergency Response and Cooperation Plan
ERYC	East Riding of Yorkshire Council
ES	Environmental Statement
ESFJC	Eastern Sea Fisheries Joint Committee
EU	European Union
FEPA	Food and Environment Protection Act
FFC	Flamborough and Filey Coast
FHBC	Flamborough Head and Bempton Cliffs
FIR	Flight Information Region
FL	Flight Level
FRA	Flood Risk Assessment
ft	Feet
GAAC	General Aviation Awareness Council
GBF	Gravity Base Foundation
GES	Good Environmental Status
GIS	Geographical Information Systems
GLVIA3	Guidelines for Landscape and Visual Impact Assessment: Third Edition
GPS	Global Positioning System
GT	Gross Tonnage

HDD	Horizontal Directional Drill
HDV	Heavy Duty Vehicle (> 3.5t)
HE	Historic England
HER	Historic Environment Record
HHER	Humber Historic Environment Record
HMR	Helicopter Main Route
HRA	Habitats Regulations Assessment
Hs	Significant wave height
HSC	Historic Seascape Character
HSCA	Historic Seascape Character Area
HVAC	High Voltage Alternative Current
HVDC	High Voltage Direct Current
IALA	International Association of Lighthouse Authorities
IAMMWG	Inter-Agency Marine Mammal Working Group
IAP	Instrument Approach Procedure
IAQM	UK Institute of Air Quality Management
IBTS	International Bottom Trawl Survey
IBTSWG	International Bottom Trawl Survey Working Group
ICAO	International Civil Aviation Organisation
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IFCA	Inshore Fisheries and Conservation Authority
IFP	Instrument Flight Procedure
IHLS	International Herring Larvae Survey
ILA	Important Landscape Area
IMO	International Maritime Organisation
IPC	Infrastructure Planning Commission
ISQG	Interim Sediment Quality Guidelines
JB	Joint Bay
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
km	Kilometre
LARS	Lower Airspace Radar Service
LAT	Lowest Astronomical Tide
LCT	Landscape Character Type
LDV	Light Duty Vehicle (< 3.5t)
LFA	Low Flying Area
LI	Landscape Institute
LNR	Local Nature Reserve
LOA	Length Overall
LOS	Line of Sight
LPA	Local Planning Authority
LUC	Land Use Consultants
LWS	Local Wildlife Site
M	Metre
MAIB	Marine Accident Investigation Branch

MarESA	Marine Evidence based Sensitivity Assessment
MarLIN	Marine Life Information Network
MCA	Marine Conservation Area
MCA	Marine Character Areas
MCAA	Marine and Coastal Access Act
MERMAN	Marine Environment Monitoring and Assessment National database
Met Office	Meteorological Office
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
Mil AIP	Military Aeronautical Information Publication
MINNS	Marine Invasive Non-Native Species
MLWS	Mean Low Water Springs
MMMP	Marine Mammal Mitigation Plan
MMO	Marine Management Organisation
MOD	Ministry of Defence
MPA	Marine Plan Areas
MPCP	Marine Pollution Contingency Plan
MSFD	Marine Strategy Framework Directive
MU	Management Unit
NAIZ	Non-Automatic Initiation Zone
NATS	NATS Ltd (formerly National Air Traffic Services Ltd)
NFMS	National Marine Fisheries Service
NGET	National Grid Electricity Transmission
NHLE	National Heritage List for England
NLCA	National Landscape Character Area
NLS	National Library of Scotland
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NNR	National Nature Reserve
NO	Nitrogen oxide
NO2	Nitrogen dioxide
NOTAM	Notice to Airmen
NOx	Sum of Nitrogen oxides (NO + NO2)
NPAS	National Police Air Service
NPS	National Policy Statement
NRA	Navigation Risk Assessment
NRHE	National Record of the Historic Environment
NSCA	National Seascape Character Area
NSIP	Nationally Significant Infrastructure Project
O&M	Operations and Maintenance
OESEA3	Offshore Energy Strategic Environmental Assessment, Phase 3
OFTO	Offshore Transmission Operator
OGA	Oil and Gas Authority
OLS	Obstacle Limitation Surfaces
OnSS	Onshore Substation
OREI	Offshore Renewable Energy Installation

OREIs	Offshore Renewable Energy Installations
OWF	Offshore Wind Farm
PAD	Protocol for Archaeological Discoveries
Peak SPL	Peak Sound Pressure Level
PEIR	Preliminary Environmental Impact Report
PEL	Probable Effect Level
PEMMP	Project Environmental Management and Monitoring Plan
PEXA	Practice and Exercise Area
PEXAs	Exercise Areas and Danger Areas
PINS	Planning Inspectorate
PM10	Particulate Matter with an aerodynamic diameter of 10 µm or less
PRoW	Public Rights of Way
pSAC	Possible Special Areas of Conservation
pSPA	Potential Special Protected Area
pSPA	Proposed Special Protection Area
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
RAP	Recognised Air Picture
RDDS	Radar Data Display System
REC	Regional Environmental Characterisation
REWS	Radar Early Warning Systems
RNLI	Royal National Lifeboat Institute
RPSS	Route Planning and Site Selection
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Areas of Conservation
SAR	Search and Rescue
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCOS	Special Committee on Seals
SEA	Strategic Environmental Assessment
SELcum	Cumulative Sound Exposure Level
SELSS	Single Strike Sound Exposure Level
SLVIA	Seascape, Landscape and Visual Impact Assessment
SMA	Seal Management Area
SMRU	Sea Mammal Research Unit
SNH	Scottish Natural Heritage
SNCBs	Statutory Nature Conservation Bodies
SoCC	Statement of Community Consultation
SoCG	Statement of Common Ground
SOLAS	Safety of Life at Sea
SoS	Secretary of State
SPA	Special Protected Area
SPM	Suspended Particulate Matter
SPZs	Source Protection Zones
SRN	Strategic Road Network

SSC	Suspended Sediment Concentrations
SSR	Secondary Surveillance Radar
SSSI	Sites of Special Scientific Interest
SVR	Seascape and Visual Resource
TCE	The Crown Estate
TCPA	Time to Closest Point of Approach
TEL	Threshold Effect Level
TJB	Transition Joint Bay
TTS	Temporary Threshold Shift
UIR	Upper Information Region
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UKIAIP	UK Integrated Aeronautical Information Package
UKLFS	UK Military Low Flying System
UXO	Unexploded Ordinance
VMS	Vessel Monitoring System
VOR	Valued Ornithological Receptor
WeBS	Wetland Bird Survey
WFD	Water Framework Directive
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
WWI	First World War
WWII	Second World War
YWT	Yorkshire Wildlife Trust
ZDA	Zone Development Agreement
ZoC	Zonal Characterisation
ZTV	Zone of Theoretical Visibility

1 Introduction

1.1 Purpose of this Report

1.1.1.1 Ørsted Hornsea Project Four Limited (hereafter the Applicant) is proposing to develop Hornsea Project Four Wind Farm (hereafter Hornsea Four). Hornsea Four will be located approximately 65 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. The location of Hornsea Four is illustrated on **Figure 1-1**. The scoping boundary combines the search areas for the onshore and offshore infrastructure.

1.1.1.2 Hornsea Four has an expected capacity of greater than 100 MW and is therefore defined as a Nationally Significant Infrastructure Project (NSIP) under Section 15(3) of the Planning Act 2008 (the '2008 Act'). As such there is a requirement to apply for a Development Consent Order (DCO) to the Planning Inspectorate (PINS), who administer the examination of applications on behalf of the relevant Secretary of State (SoS). The application for a DCO will include a description of the development proposal and will be accompanied by an Environmental Statement (ES) prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the '2017 EIA Regulations'), the development falling under Schedule 2 of the 2017 EIA Regulations.

1.1.1.3 To start the DCO process the Applicant has prepared this Environmental Impact Assessment (EIA) Scoping Report, which presents an initial review of the potential issues associated with the construction, operation and maintenance, and eventual decommissioning of Hornsea Four. The purpose of the Scoping Report is to request a formal Scoping Opinion from the SoS in accordance with Regulation 10 of the 2017 EIA Regulations and to ensure a proportionate EIA. The benefits of delivering proportionate EIA, as defined by the Institute of Environmental Management and Assessment (IEMA) (2017), are to:

- drive collaborative action and understanding across the EIA community;
- focus assessments so their findings are accessible to all stakeholders;
- reduce uncertainty and risk within project consenting;
- save time and costs for developers, consenting authorities and consultees; and
- allow more time to be spent exploring the delivery of environmental improvements.

1.1.1.4 One of the key actions for delivering proportionate EIA is to improve scoping so that it becomes a core process running through the EIA, which presents ongoing opportunities to define and redefine what information is of value and how it is made available to stakeholders. Therefore an integral element of this report is to focus on aspects which the Applicant believes can be scoped out in the interest of proportionality, and to describe and share the tools it will continue to use throughout the EIA. These tools include the Impacts Register, Commitments Register and the Route Planning and Site Selection Process. Each of these and the way in which they add towards proportionality is described further in **section 5.4**. The ES, which reports the proportionate EIA, will be based on the Scoping

Opinion, informed by the recommendations of the consultees and the information contained within this Scoping Report.

1.2 Background

1.2.1 Former Hornsea Zone

1.2.1.1 The former Hornsea Zone was one of nine offshore wind generation zones around the UK coast identified by The Crown Estate (TCE) during its third round of offshore wind licensing. As part of a competitive tender, SMart Wind Ltd., a then 50/50 joint venture between International Mainstream Renewable Power (Offshore) Ltd and Siemens Project Ventures GmbH, was awarded the rights to the development of the former Hornsea Zone by entering into a Zone Development Agreement (ZDA) with TCE in 2009.

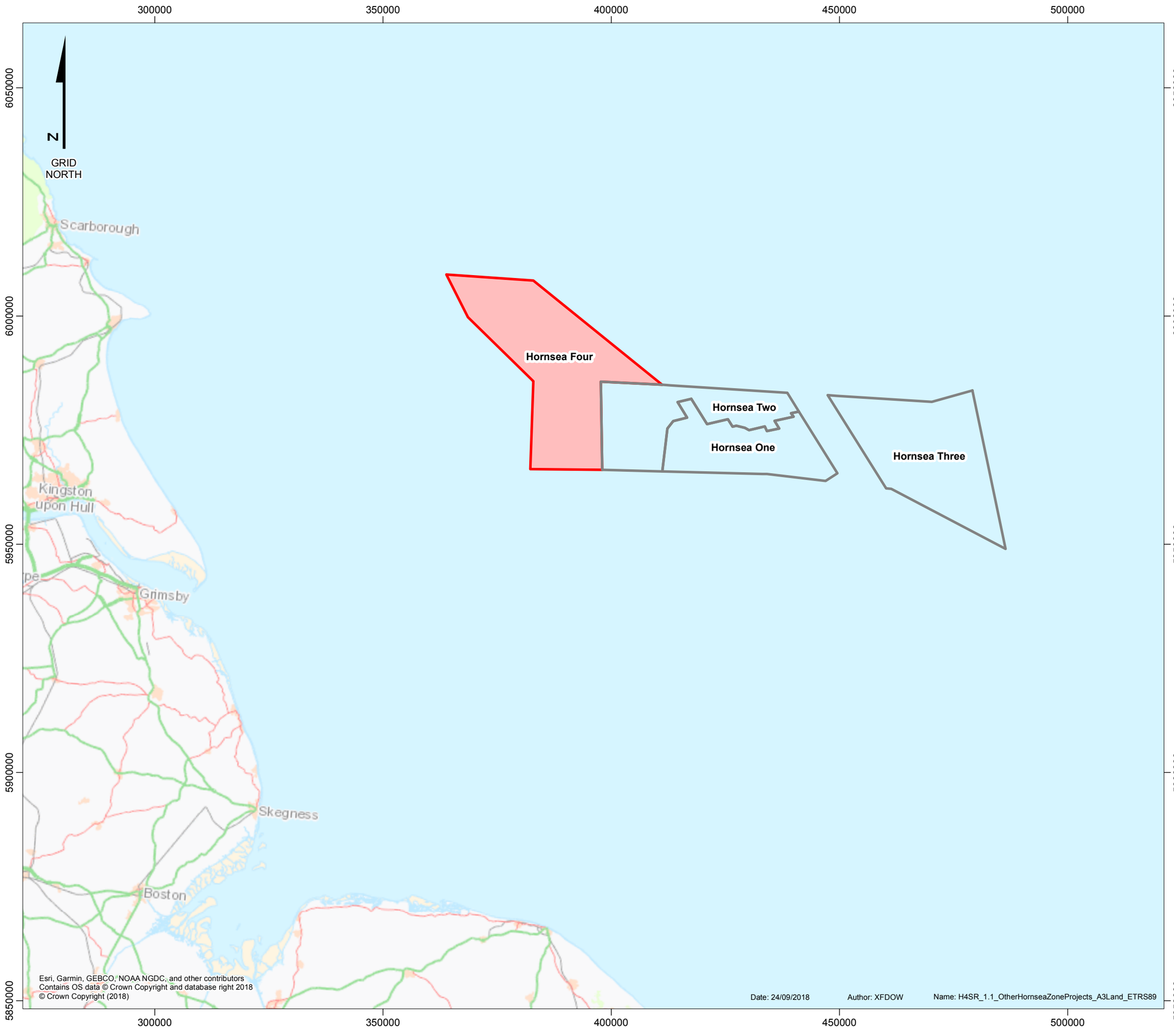
1.2.1.2 DONG Energy Wind Power A/S (now Ørsted Wind Power A/S) acquired the development rights to Hornsea Project One in February 2015 and, in August 2015, DONG Energy Power (UK) Ltd.) acquired SMart Wind Ltd and the then Hornsea Zone, together with the development rights for Hornsea Project Two, Hornsea Project Three and Hornsea Four. Subsequently in March 2016, the Hornsea ZDA was terminated and project specific agreements, Agreement for Leases (AfLs), were agreed with TCE for Hornsea Project One, Hornsea Project Two, Hornsea Project Three and Hornsea Four. The Hornsea Zone has therefore been dissolved and is referred to throughout this Scoping Report as the former Hornsea Zone.

1.2.2 Hornsea Projects

1.2.2.1 The first project to be proposed within the former Hornsea Zone was Hornsea Project One. Hornsea Project One included up to three offshore wind farms with a maximum generating capacity of
1,200 MW and the associated connections to shore. The SoS granted development consent for Hornsea Project One on 10 December 2014. The second project to be proposed within the former Hornsea Zone was Hornsea Project Two. Hornsea Project Two comprises up to two offshore wind farms with a maximum generating capacity of 1,800 MW. The SoS granted development consent for Hornsea Project Two on 16 August 2016. The third project to be proposed within the former Hornsea Zone was Hornsea Project Three which submitted an application for Development Consent in May 2018. If consented, Hornsea Project Three will comprise an offshore wind farm with up to 300 wind turbines.

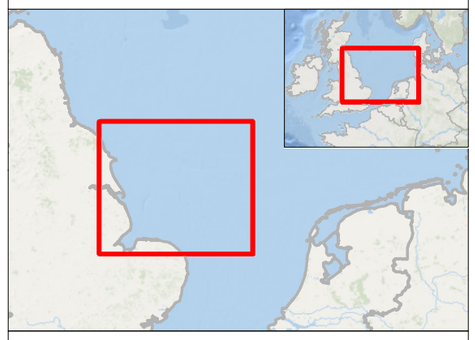
1.2.2.2 The location of Hornsea Four in relation to the existing Hornsea projects is shown on **Figure 1-1**. Hornsea Four will have similarities to the existing Hornsea projects both in terms of the nature of the project and its location. As a result, the ES will take into account the results of EIAs for the existing Hornsea projects in order to avoid duplication of assessment. It will also take into account matters that have been raised during consultation on the existing Hornsea projects that are applicable to the Hornsea Four EIA within this Scoping Report.

Hornsea Four
Other Hornsea Zone Projects
Figure 1.1



Array Area

Offshore Wind Farm



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:800000

0 10 20 40 Kilometres

0 5 10 20 Nautical Miles

Other Hornsea Zone Projects
Document no: H4SR_1.1
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Checked by: KIEBE
Approved by: JULCA

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1.3 The Scoping Boundary

1.3.1.1 Figure 1-2 illustrates the scoping boundary that has been used to inform this Scoping Report. The scoping boundary is defined as the area within which the project and electrical infrastructure will be located, including the temporary work areas. The boundary combines the Hornsea Four Array, onshore substation and landfall search areas and a buffer zone applied to an indicative centreline for the potential export cable corridor. This buffer zone is 1 km either side of the indicative potential onshore export cable centreline and 1.5 km either side of the indicative potential offshore export cable centreline.

1.4 Notification that DCO Application will be accompanied by an ES

1.4.1.1 The Applicant hereby gives notice, pursuant to Regulation 8(1)(b) of the 2017 EIA Regulations, that the application for a DCO will be accompanied by an ES. The ES will include at least the information set out in Regulation 14(a) – (e) and any additional information specified in Schedule 4 relevant to the specific characteristics of Hornsea Four and to the environmental features likely to be significantly affected. It will include the information reasonably required for reaching a reasoned conclusion on the significant effects of Hornsea Four.

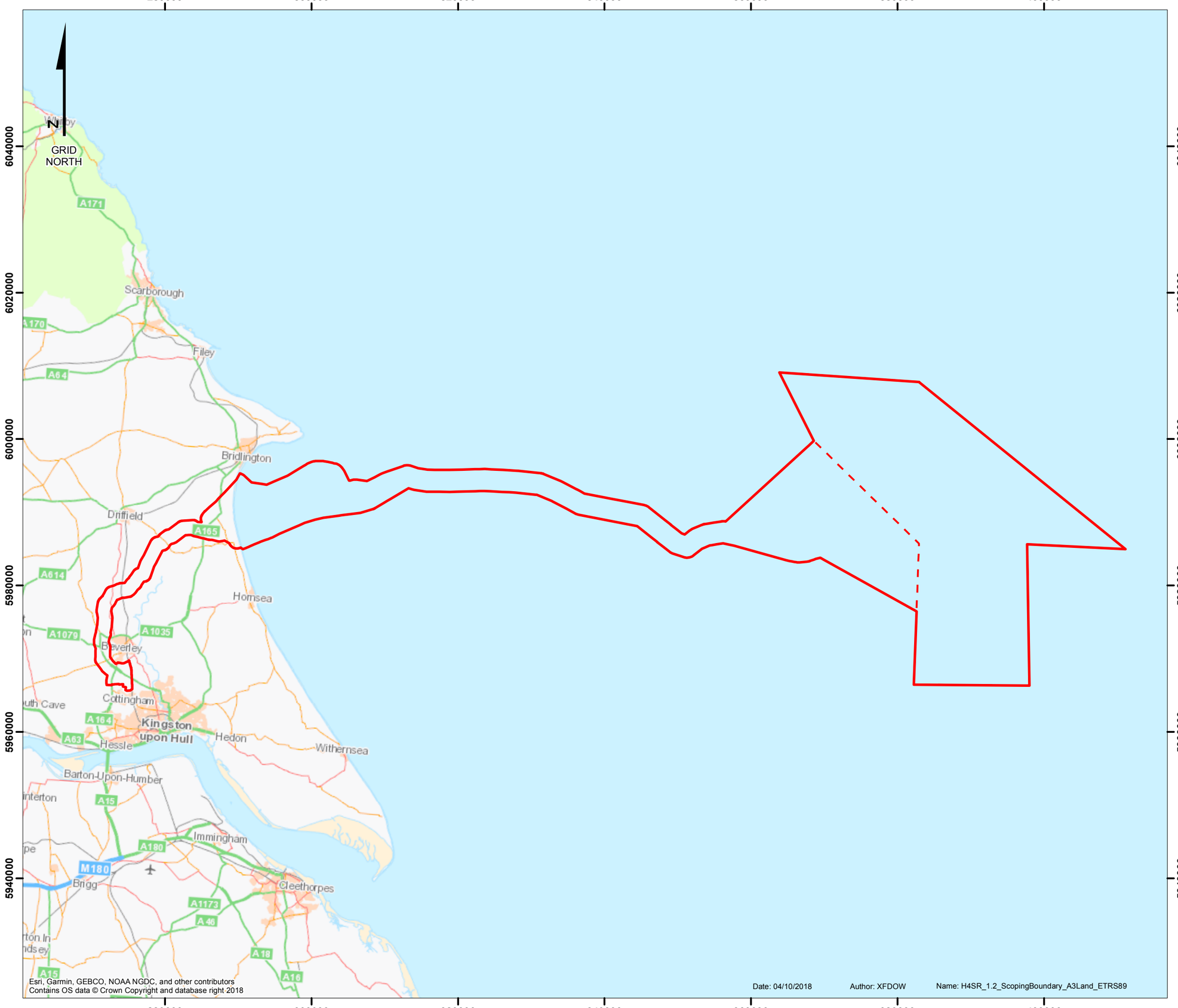
1.5 Request for Scoping Opinion

1.5.1.1 This Scoping Report supports a request for a formal EIA Scoping Opinion. The Scoping Opinion will contain a compilation of responses to this document from statutory and other key stakeholders, which will guide the Applicant in progressing an EIA for Hornsea Four. The Applicant requests that the SoS sets out in writing its opinion as to the scope, and level of detail of, information to be provided in the ES. This Scoping Report contains the following information:

- a description of the proposed development, including its location and technical capacity;
- an explanation of the likely significant effects on the environment; and
- such other information the Applicant considers material.

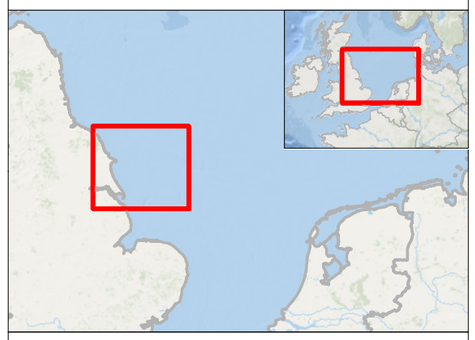
1.5.1.2 A plan of Hornsea Four is provided in Figure 1-1, and a brief description of the nature and purpose of the project and its possible effects on the environment are provided in Chapter 3 and Chapters 6-7 respectively. The individual topic areas within Chapters 6-7 include matters of particular importance that the Applicant would like consultees to consider and respond to within the Scoping Opinion.

Hornsea Four
Scoping Boundary
Figure 1.2



Scoping Boundary

Array Area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 5 10 20 Kilometres

0 2.5 5 10 Nautical Miles

Scoping Boundary
Document no: H4SR_1.2
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Approved by: JULCA

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1.6 Hornsea Four Team

1.6.1 The Applicant

1.6.1.1 The Applicant (Ørsted Hornsea Four Ltd) and Ørsted Power (UK) Ltd are owned by Ørsted A/S. Ørsted A/S specialises in procuring, producing, distributing and trading energy and related products in Northern Europe. Ørsted A/S is the world leader in the construction and operation of offshore wind farms, with more than 25 years' experience and a strong track record in delivering successful projects, with approximately 4.4 GW of operational offshore wind farms worldwide, and a further 4.5 GW under construction.

1.6.2 The EIA Team

1.6.2.1 The preparation of the EIA is being led by Environmental Resources Management (ERM) working closely with GoBe Consultants Ltd (GoBe). Pursuant to Regulation 14(4) of the 2017 EIA Regulations the ES will be prepared by competent experts and the ES will outline the relevant expertise or qualifications of the experts. In addition, a number of specialist consultancies are providing expert input into the EIA topic chapters, as indicated in **Table 1-1**.

1.6.2.2 Pinsent Masons LLP has been instructed to provide legal advice throughout the Hornsea Four Development Consent application process.

Table 1-1 Hornsea Project Four Overview

	Topic	Author
Offshore	Marine and Coastal Processes	GoBe and Cooper Marine Advisors
	Benthic and Intertidal Ecology	GoBe
	Fish and Shellfish Ecology	GoBe
	Marine Mammals	GoBe and SMRU Consulting
	Offshore and Intertidal Ornithology	GoBe and APEM Ltd
	Marine Archaeology	Maritime Archaeology Ltd
	Commercial Fisheries	Poseidon Aquatic Resource Management Ltd
	Shipping and Navigation	Marine and Risk Consultants Ltd (Marico Marine)
	Aviation, Radar, Military and Communications	Osprey Consulting Services Ltd
	Seascape and Visual Resources	Optimised Environments Limited (OPEN)
	Infrastructure and Other Users	GoBe, supported by University of Manchester (Manchester Advanced Radar Services)
	Subsea Noise	Subacoustech Environmental Ltd
Onshore	Planning and Policy Context	ERM
	Geology and Ground Conditions	ERM
	Hydrology and Flood Risk Assessment	ERM
	Ecology and Nature Conservation	ERM
	Landscape and Visual Impact	Land Use Consultants (LUC)
	Historic Environment	ERM

	Topic	Author
	Land Use and Agriculture	LUC
	Traffic and Transport	Curtins
	Socio-economic Characteristics	ERM
	Noise and Vibration	ERM
	Air Quality and Heath	ERM

1.6.2.3 For the purposes of the EIA, including this Scoping Report, 'offshore' generally refers to the receptors on the seaward side of Mean High Water Springs (MHWS) and 'onshore' refers to the receptors on the landward side of MHWS.

1.7 General Approach to Scoping Matters In and Out

1.7.1.1 This Scoping Report has been produced in accordance with the 2017 EIA Regulations and other guidance documents (see **section 5.2**). In particular, PINS Advice Note Seven (PINS, 2017) observes that, although not a statutory requirement, the Scoping Opinion is an important document and the 2017 EIA Regulations require the ES to be based on the most recent one adopted. The note identifies that the scoping process allows for an early identification of the likely significant effects applicable to the EIA Regulations and also provides an opportunity to agree where aspects and matters can be scoped out from further assessment.

1.7.1.2 Section 4.10 of Advice Note Seven highlights the essential need to ensure that ESs are appropriately focused on aspects and matters where a likely significant effect may occur, and thereby ensuring that the EIA process is proportionate. This includes scoping out from the need for further assessment aspects and matters where it is appropriate to do so. Advice Note Seven goes on to advise that applicants should ensure that their scoping request includes sufficient justification for scoping aspects/matters out, and that this justification should be evidence-based and have reference to the assessment process.

Information to address the following questions is specifically advised by Section 4.11 of Advice Note Seven in seeking to scope matters out:

- Is there an impact pathway from the Proposed Development to the aspect/matter?
- Is the aspect/matter sensitive to the impact concerned?
- Is the impact likely to be on a scale that may result in significant effects to the aspect/matter?
- Could the impact contribute cumulatively with other impacts to result in significant effects to the aspect/matter?
- Is there a method of avoidance or mitigation that would reduce the impact on the aspect/matter to a level where significant effects would not occur?
- Is there sufficient confidence in the avoidance or mitigation method in terms of deliverability and efficacy to support the request?
- Is there empirical evidence available to support the request?
- Do relevant statutory consultees agree with the request?
- Have you had regard to (a) relevant National Policy Statement(s) (NPS) and specifically any requirement stated in the NPS(s) in respect of the assessment of this aspect/matter?

2 Planning and Policy Context

2.1 UK Energy Policy and the Role of Renewable Energy

2.1.1.1 The 'Meeting the Energy Challenge' white paper (DTI, 2007) published by the former Department for Business, Enterprise and Regulatory Reform (BERR), now the Department of Business, Energy and Industrial Strategy (BEIS), described two long-term challenges for the UK:

- tackling climate change by reducing carbon dioxide emissions both within the UK and abroad; and
- ensuring secure, clean and affordable energy.

2.1.1.2 The UK is a signatory to the Kyoto Protocol which commits state parties to reduce greenhouse gas emissions. The protocol came into effect in 2005 and its commitments were transposed into UK law by the Climate Change Act 2008, which places a duty on the SoS to ensure that the net UK carbon account for the year 2050 is 80% lower than the 1990 baseline.

2.1.1.3 At a European Union (EU) level the Renewables Directive (Directive 2009/28/EC) requires that by 2020, some 20% of the EU's energy consumption must come from renewable sources. As part of this process the 'UK Renewable Energy Strategy' (The SoS for Energy and Climate Change, 2009) set the UK's commitment to source 15% of its energy from renewable sources by 2020.

2.1.1.4 The Energy Act 2013 provides further commitment from the UK to achieving a low carbon energy industry and incentivises investment in low carbon electricity generation. The Energy Act 2013 committed BEIS to Electricity Market Reform and the replacement of Renewables Obligations Certificates (RoCs) with Contracts for Difference (CfDs) to reduce public spend but also still encourage investment in low carbon electricity generation such as offshore wind power.

2.1.1.5 The Clean Growth Strategy (2017) promotes 'clean growth' as growing national income while cutting greenhouse gas emissions. Clean growth forms one of the four 'grand challenges' within the UK's Industry Strategy (2017). The UK has been one of the most successful countries in the developed world in growing its economy while reducing emissions. This success has been aided by the falling costs of many low carbon technologies including solar and offshore wind. The Strategy aims to promote further growth of offshore wind by holding a second auction of CfDs, working with the industry to develop a Sector Deal for offshore wind, and to provide further funding for innovation in offshore wind.

2.1.1.6 The first National Infrastructure Assessment by the National Infrastructure Commission (NIC, 2018) recommends that half of the UK's power is provided by renewables by 2030. This represents a substantially more ambitious target compared to the EU Renewables

Directive and UK Renewable Energy Strategy, and is partly driven by the cost competitiveness of offshore wind energy generation.

2.2 Planning Consents and EIA

2.2.1.1 This section summarises the development consent process under the Planning Act 2008 (as amended), in order to construct and operate Hornsea Four, as well as describing the UK and EU legal requirements for the Hornsea Four EIA.

2.2.2 The Planning Act 2008

2.2.2.1 The Planning Act 2008 (as amended) is the primary piece of legislation that establishes the legal framework for the application, examination and determination of applications for NSIPs. It sets out the consenting system for all NSIPs, including those in the energy sector.

2.2.2.2 Part 2 of the Act specifies the provisions in relation to National Policy Statements (NPSs), which set the framework for decisions by the SoS. The NPSs also identify relevant environmental considerations. To date there are 12 NPSs published, relating to different types of infrastructure projects. There are six energy NPSs, three of which are relevant to offshore wind farm development, specifically, The Overarching NPS for Energy (NPS EN-1), The NPS for Renewable Energy Infrastructure (NPS EN-3) and The NPS for Electricity Networks Infrastructure (NPS EN-5) (DECC, 2011a; DECC, 2011b; DECC, 2011c).

2.2.2.3 Amendments have been made to the planning system that are applicable to the Planning Act 2008, through the Localism Act 2011. Under the Localism Act 2011, PINS became the executive agency responsible for the NSIP planning process. Any developer wishing to construct a project that is classified as an NSIP must apply for Development Consent. PINS will examine the application submissions and make a recommendation to the SoS for BEIS to grant or refuse consent.

2.2.3 The Development Consent Order (DCO) and Environmental Statement

2.2.3.1 Section 31 of the Planning Act 2008 states that a DCO is required for all development is or forms part of a NSIP. Insofar as a project benefits from a DCO, the following is not required:

- planning permission under the Town and Country Planning Act 1990;
- consent under section 36 or 37 of the Electricity Act 1989), ;
- listed building and conservation area consent under the Planning (Listed Buildings and Conservation Areas) Act 1990; and
- Scheduled Monument consent under the Ancient Monuments and Archaeological Areas Act 1979.

2.2.3.2 The DCO will provide for Hornsea Four in its entirety (i.e. both the offshore and the onshore aspects of Hornsea Four), with electrical grid connection works comprising the offshore export cabling, offshore HVAC booster station(s), landfall works, onshore export cabling,

onshore substation including connection into the National Grid substation and 'associated development'. In addition to the principal consents for Hornsea Four, any additional consents and licences will be identified during the development stage and through consultations with statutory bodies.

2.2.3.3 A formal EIA will be required as part of the application for a DCO. An ES will be prepared, which is the formal report documenting the EIA process. The ES will be prepared in accordance with the 2017 EIA Regulations. These Regulations implement the EIA Directive for consent applications made under the Planning Act 2008. The aim of the EIA Directive is to ensure that when a relevant authority giving consent for a particular project makes its decision, it does so in the knowledge of any likely significant effects on the environment.

2.2.4 Marine and Coastal Access Act (MCAA) 2009

2.2.4.1 The Marine and Coastal Access Act (MCAA) 2009 introduced a spatial planning system for marine environmental management and a requirement to obtain Marine Licences for works at sea.

2.2.4.2 The MCAA inserted section (Section 149A) into the Planning Act 2008 which enables an applicant for a DCO to apply for 'deemed Marine Licences' as part of the DCO process. The Marine Management Organisation (MMO) is the responsible authority for licensing under the MCAA and are thus a key stakeholder where deemed Marine Licences are included in the DCO. The MMO remains the monitoring and enforcement body in respect of the conditions and restrictions set out in the deemed Marine Licences.

2.3 The Application and Consenting Process

2.3.1 The Development Consent Order Process

2.3.1.1 The DCO will provide statutory consent for the development of Hornsea Four. The process for obtaining a DCO is split into the following phases: pre-application, acceptance, pre-examination, examination, decision and post decision.

2.3.1.2 During the pre-application phase, Part 5 of the Planning Act 2008 requires promoters of a DCO application to engage in pre-application consultation with local communities, local authorities and those who would be directly affected by the proposals. The 2017 EIA Regulations make provisions for various matters in connection with making an application for Development Consent, including publicising a proposed application and consulting with local and statutory stakeholders. Further details regarding the consultation process are included in the Statement of Community Consultation (SoCC) found at www.hornseaprojects.co.uk/hornsea-project-four/.

2.3.1.3 The Hornsea Four application will be submitted to PINS with the prescribed forms and documents as required by the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009. Regulation 5(2)(a) requires that, where applicable, an application must be accompanied by *"the environmental statement required pursuant to*

the Infrastructure Planning (Environmental Impact Assessment) Regulations [2017] and any scoping or screening opinions or directions". A number of other supporting documents are also required to be submitted, including:

- a Consultation Report;
- a Draft DCO and Explanatory Memorandum; and
- a Habitat Regulations Assessment (HRA) Report (see **section 2.3.3**).

2.3.2 The Environmental Impact Assessment (EIA) Process

2.3.2.1 Directive 2011/92/EU, as amended by Directive 2014/92/EU (known as the "EIA Directive"), requires an EIA to be completed in support of a DCO for certain types of projects. Offshore wind farms are listed in Annex II of the Directive, as *"installations for the harnessing of wind power for energy production (wind farms)"*.

2.3.2.2 In the UK, the Directive is applied to offshore wind farm projects and associated onshore infrastructure through the 2017 EIA Regulations. These Regulations set out the statutory process and minimum requirements for the provision of adequate environmental information to enable the EIA process. The EIA, activities, surveys and studies will be reported in the Hornsea Four ES.

2.3.2.3 The EIA process can be broadly summarised as consisting of three main elements that take place prior to the submission of the DCO and ES.

- Scoping: project promoters can request a formal Scoping Opinion from PINS.
- Consultation: the project promoter is required to conduct pre-application consultation in accordance with the Planning Act 2008 plus associated guidance and Regulations, which includes the 2017 EIA Regulations. The SoCC identifies the proposed consultation activities.
- ES Preparation: the ES is prepared taking into account the responses to the consultation process. An additional consultation process also takes place where consultation responses on the Preliminary Environmental Information Report (PEIR) are invited. The final ES is then prepared taking into account comments on the PEIR.

2.3.3 Habitats Regulations Assessment (HRA)

2.3.3.1 The Conservation of Habitats and Species Regulations 2017 (Habitats Regulations) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (Offshore Habitat Regulations) require the assessment of any significant effects on qualifying features of internationally important nature conservation sites that are likely to arise as a result of a proposed project. These internationally important sites include Special Areas of Conservation (SACs), or candidate SACs (cSACs), Special Protection Areas (SPAs) or potential SPAs (pSPAs), Sites of Community Importance (SCIs) and Ramsar sites. These are

often referred to as European Conservation Sites. This assessment is to be undertaken by the 'competent authority', which in the case of Hornsea Four is the SoS for BEIS.

2.3.3.2 In order to carry out the HRA, the competent authority, under Regulation 5(2)(g) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, requires a report to be submitted alongside the ES. As such, the HRA does not form part of the ES, although the baseline presented contains some of the same information.

3 Project Description

3.1 Introduction

3.1.1.1 This chapter provides an overview of Hornsea Four. It sets out the design and main components of the offshore wind farm, associated infrastructure and energy balancing infrastructure. It also describes the key activities that will be undertaken during construction, operations and maintenance (O&M) and decommissioning, including key parameters along with indicative timescales.

3.1.1.2 At this early stage in Hornsea Four, the project description is indicative and the 'envelope' has been designed to include sufficient flexibility to accommodate further refinement during detailed design. This chapter therefore sets out a series of options and/or parameters for which maximum values are used to constitute a realistic Maximum Design Scenario (MDS) for Hornsea Four.

3.1.1.3 The project description will be expanded as Hornsea Four develops through the EIA process: in the next stage within the PEIR; and finally, within the ES that will accompany the application for Development Consent to the SoS.

3.2 Design Envelope Approach

3.2.1.1 The use of the Design Envelope approach has been recognised in the Overarching NPS for Energy (NPS EN-1) (DECC, 2011a) and the NPS for Renewable Energy Infrastructure (NPS EN-3) (DECC, 2011b). This approach has been used in the majority of offshore wind farm applications.

3.2.1.2 In the case of offshore wind farms, NPS EN-3 (paragraph 2.6.42) recognises that: "Owing to the complex nature of offshore wind farm development, many of the details of a proposed scheme may be unknown to the applicant at the time of the application, possibly including:

- *Precise location and configuration of turbines and associated development;*
- *Foundation type;*
- *Exact turbine tip height;*
- *Cable type and cable route; and*
- *Exact locations of offshore and/or onshore substations."*

3.2.1.3 NPS EN-3 (paragraph 2.6.43) continues:

"The Secretary of State should accept that wind farm operators are unlikely to know precisely which turbines will be procured for the site until sometime after any consent has been granted. Where some details have not been included in the application to the Secretary of State, the applicant should explain which elements of the scheme have yet to be finalised, and the reasons. Therefore, some flexibility may be required in the consent. Where this is sought and the precise details are not known, then the applicant should assess the effects the

project could have to ensure that the project as it may be constructed has been properly assessed (the Rochdale [Design] Envelope)". (DECC, 2011b).

3.2.1.4 NPS EN-3 also states that: "The 'Rochdale [Design] Envelope' is a series of maximum extents of a project for which the significant effects are established. The detailed design of the project can then vary within this 'envelope' without rendering the ES [Environmental Statement] inadequate".

3.2.1.5 The Design Envelope approach is widely recognised and is consistent with PINS' Advice Note Nine: Rochdale Envelope (PINS, 2012) which states that: *"The 'Rochdale Envelope' is an acknowledged way of dealing with an application comprising EIA development where details of a project have not been resolved at the time when the application is submitted".*

3.2.1.6 Throughout the Scoping Report and subsequent EIA, the Design Envelope (otherwise known as the "Rochdale Envelope") Approach has been taken to allow meaningful assessments of Hornsea Four to proceed, whilst still allowing reasonable flexibility for future project design decisions.

3.2.1.7 Further detail on applying the Rochdale Envelope approach is included in **section 5.8**.

3.3 Project Infrastructure Overview

3.3.1.1 The key components of Hornsea Four are described in **Table 3-1** and illustrated in **Figure 3-1**.

3.3.1.2 There are two main transmission technologies being considered for Hornsea Four, defined by the type of current: High Voltage Alternative Current (HVAC) and High Voltage Direct Current (HVDC). The project will decide on which transmission type it will use during the detailed design and procurement stage, post-consent, based on a range of factors including project economics and technology risk. Both electrical systems are presented schematically in **Figure 3-1**. HVAC would require an Offshore HVAC Booster Stations for the reasons explained in **Table 3-1**.

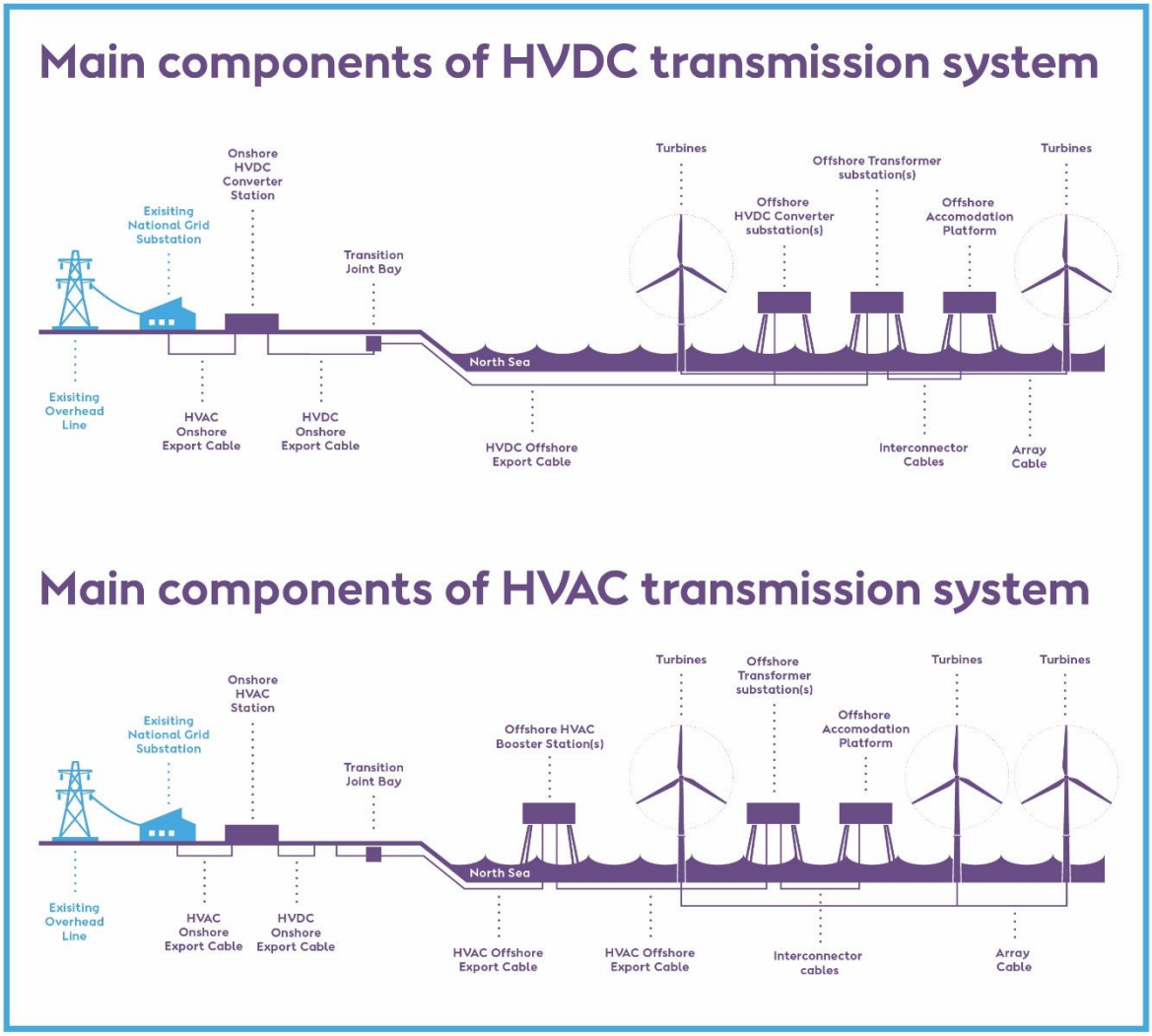


Figure 3-1 Overview of Hornsea Four Infrastructure

Table 3-1 Hornsea Four Overview

Infrastructure	Components	Detail
Offshore wind farm	Wind Turbines	The Wind Turbines convert wind energy to electricity. Key components include rotor blades, gearboxes (in some cases), transformers, power electronics and control equipment. Offshore turbine models are continuously evolving and improving, therefore the exact wind turbine model will be selected post-consent from the range of models available at the point of procurement. However, they are likely to have three blades and a horizontal rotor axis
	Wind turbine foundations	The wind turbines will be permanently attached to the seabed with foundation structures. These are typically fabricated from steel or concrete. A limited number of foundation designs are under consideration.
	Substation (transformer and convertor)	One or more substations to convert the power to higher voltages and/or to HVDC in order to transmit the power more efficiently (reduced electrical losses) to shore. The number of substations will depend on their size, i.e. either fewer larger substations, or more numerous smaller substations, or a combination.
	Accommodation platform	The wind farm may include an accommodation platform to provide permanent on-site facilities for operations staff and their tools, equipment and spare parts.
	Array cables and interlink cables	Cables will connect the wind turbines to one of the offshore substations, typically in branched strings. Cables will be buried and may require a hard-protective layer (such as rock or concrete mattresses) to ensure that the cables remain secure and do not become a hazard to other sea users and are not damaged by waves and currents. In order to improve the reliability of the transmission system, interconnector cables may be installed connecting the offshore substations to each other. Similarly, a cable may connect to the accommodation platform, to provide it with power.

Infrastructure	Components	Detail
	Scour and cable protection	In order to protect the seabed around foundation structures and cables from scour, some rocks and other materials may be placed on the seabed to protect from current and wave action.
Offshore export cable route	Export cables	Cables connecting the offshore substations to the landfall. Cables will be routed to avoid major seabed obstacles and minimise electrical losses. Cables will be delivered in sections and jointed in-situ.
	HVAC Booster Stations	The distance that High Voltage Alternative Current (HVAC) electrical export infrastructure can operate is limited because of electrical losses. However, this range can be extended by installing booster substations. These booster substations will be located offshore at a mid-point between the offshore wind farm and the grid connection point (and hence are not located within the wind farm array area). Booster stations are similar in design but smaller than the main offshore wind farm substation. Typically, booster stations would be designed as surface structures, however seabed structures are also considered. The number will of booster stations will depend on their size of the design, i.e. a single larger substation, or more numerous smaller substations.
	Scour and cable protection	In order to protect the seabed around foundation structures and cables from scour, some rocks and other materials may be placed on the seabed to protect from currents and wave action.
Onshore	Export cables	Cables connecting the landfall first to the onshore substation and then on to the National Grid substation at Creyke Beck. Where possible and practical, less intrusive construction methods will be adopted for example by using HDD to cross environmentally sensitive water courses, major roadways and railways. Cables will be delivered in sections and buried in trenches, which will subsequently be reinstated to pre-existing condition as far as reasonably practical. Sections will be connected together within jointing bays.
	Onshore substation	The onshore substation will be located as close as practical to the National Grid substation at Creyke Beck and will include all necessary electrical plant to meet the requirements of the National Grid.

Infrastructure	Components	Detail
	Energy balancing infrastructure	The onshore substation may incorporate energy balancing infrastructure, such as battery banks. These provide valuable services to the electrical grid, such as storing energy to meet periods of peak demand and improving overall reliability.
	Grid connection	In the vicinity of the National Grid Electricity Transmission (NGET) substation at Creyke Beck

3.3.1.3 All the key components of the proposed Hornsea Four development are located within the Scoping boundary (e.g. generation assets such as wind turbines within the Hornsea Four AfL and transmission assets such as electrical export cables) as illustrated in Figure 3-2.

3.3.2 The Wind Farm Site

3.3.2.1 The Hornsea Four AfL area is presented in Figure 3-2 and its key characteristics summarised in Table 1-1.

Table 3-2 Hornsea Four Wind Farm Site Overview

Parameters		Values
Wind farm site	AfL area	846 km^2
	Closest distance to shore	65 km
	Water depth	24-63 m

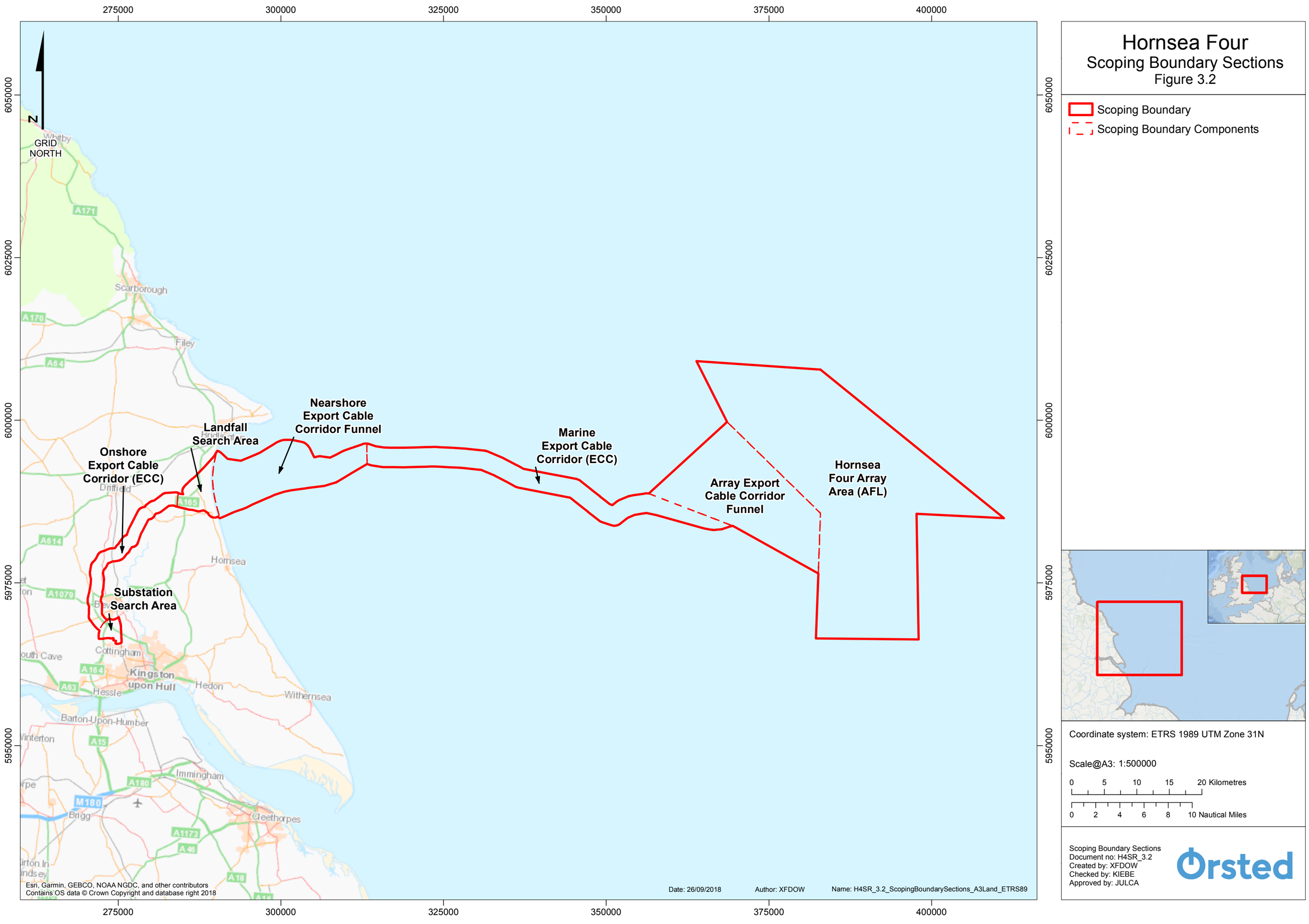
3.3.3 Wind Turbines

3.3.3.1 The maximum design scenario for the wind turbines is outlined in Table 3-3 and illustrated in Figure 3-3.

Table 3-3 Maximum Design Scenario: Wind Turbines

Parameters	Design envelope
Maximum number of wind turbines	180
Maximum rotor diameter	305 m
Maximum blade tip height	370 m above Lowest Astronomical Tide
Minimum blade tip height	35 m above Lowest Astronomical Tide

Hornsea Four
Scoping Boundary Sections
Figure 3.2



Scoping Boundary

Scoping Boundary Components

Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 5 10 15 20 Kilometres

0 2 4 6 8 10 Nautical Miles

Scoping Boundary Sections
Document no: H4SR_3.2
Created by: XFDOW
Checked by: KIEBE
Approved by: JULCA

Ørsted

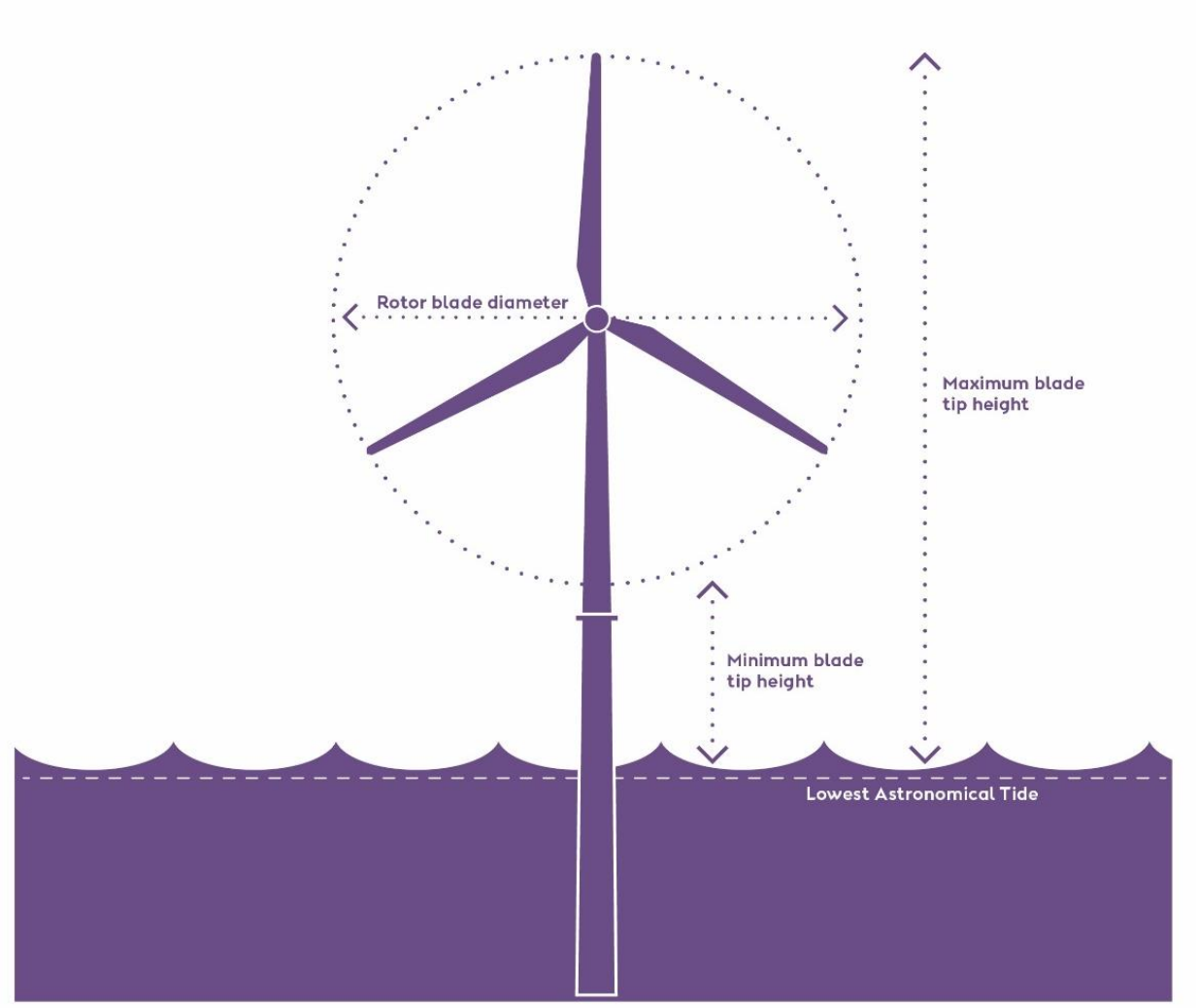


Figure 3-3 Overview of a Typical Wind Turbine

3.3.4 Wind Turbine, Offshore Substation and Offshore Accommodation Platform Foundations

3.3.4.1 The foundation type and design for WTGs, offshore substations and offshore accommodation platforms will depend on final site investigations and procurement

negotiations, which will be completed post-consent. Consequently, the EIA will consider a range of foundation types as set out in Figure 3-4 and Figure 3-5.

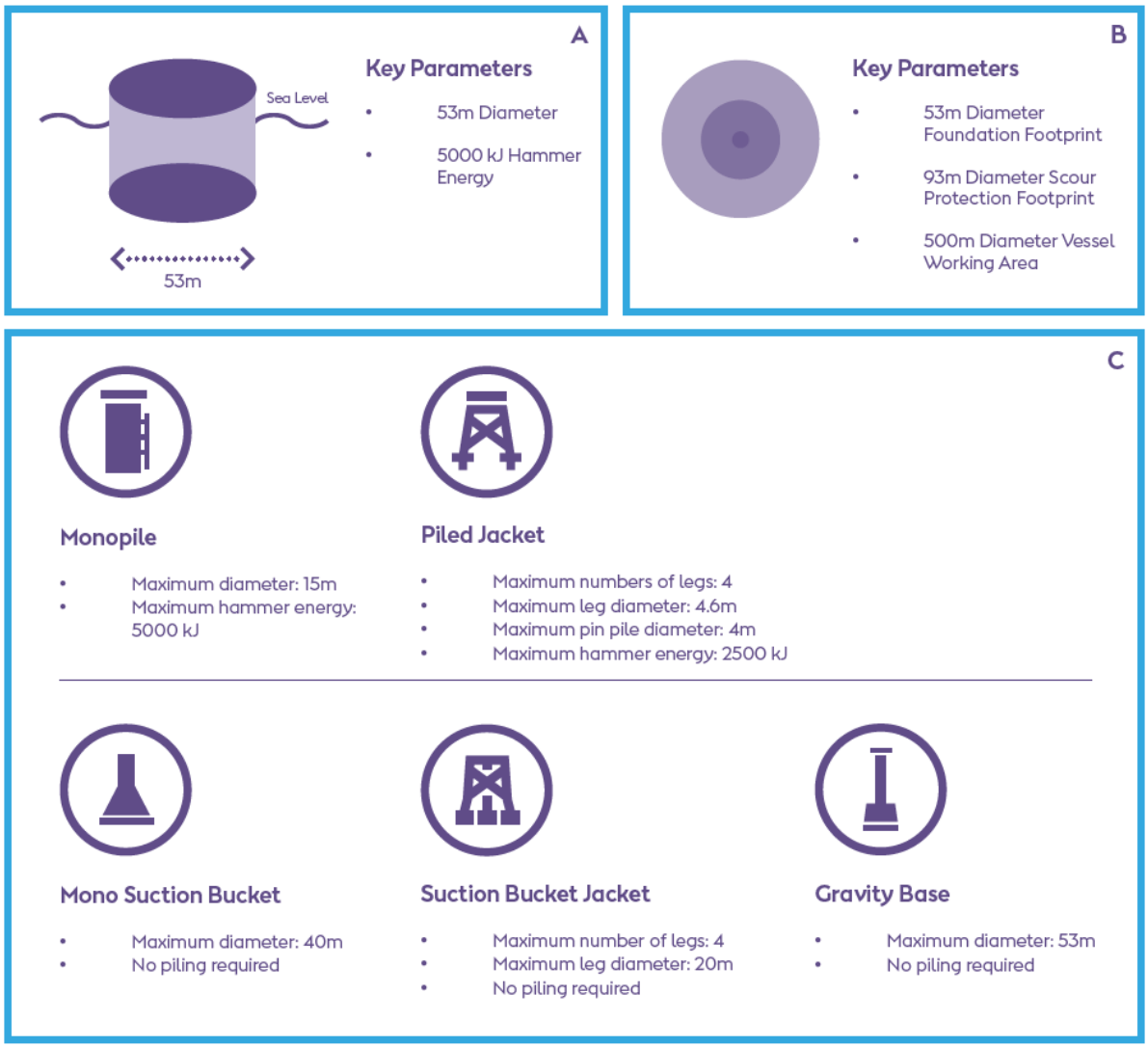


Figure 3-4 Overview of Wind Turbine Foundation Types

3.3.4.2 Insets A and B in Figure 3-4 are schematics presenting the Maximum design scenario for all WTG foundation types shown in inset C.

- Inset A. All WTG foundations (maximum of 180) fit within the 53 m worst-case cylinder diameter (seabed and sea-level) and require a maximum 5,000 kJ piling energy for installation (monopile and jacket).

- Inset B. All WTG foundations have a maximum seabed footprint of 53 m diameter, 93 m diameter scour protection and a 500 m temporary works area for construction vessels.

- Inset C. All WTG foundation types considered within the Hornsea Four Design Envelope.

3.3.4.3 Some form of seabed preparation may be required for each foundation type. Seabed preparations may include seabed levelling, ground reinforcement and removing surface and subsurface debris such as boulders, fishing nets, lost anchors etc. If debris are present below the seabed surface then excavation may be required for access and removal. Any unexploded ordnances found with live ammunition will be detonated and any remaining debris removed, where practicable.

3.3.4.4 Consent for UXO removal will be sought in a future Marine Licence application, when geophysical survey data of suitable spatial resolution is available to identify and quantify UXO.

3.3.4.5 The foundations will be fabricated offsite, stored at a suitable port facility and transported to site as needed. Specialist vessels will be needed to transport and install foundations. A scour protection layer (typically rock) may be needed on the seabed and would be installed either before or after foundation installation.

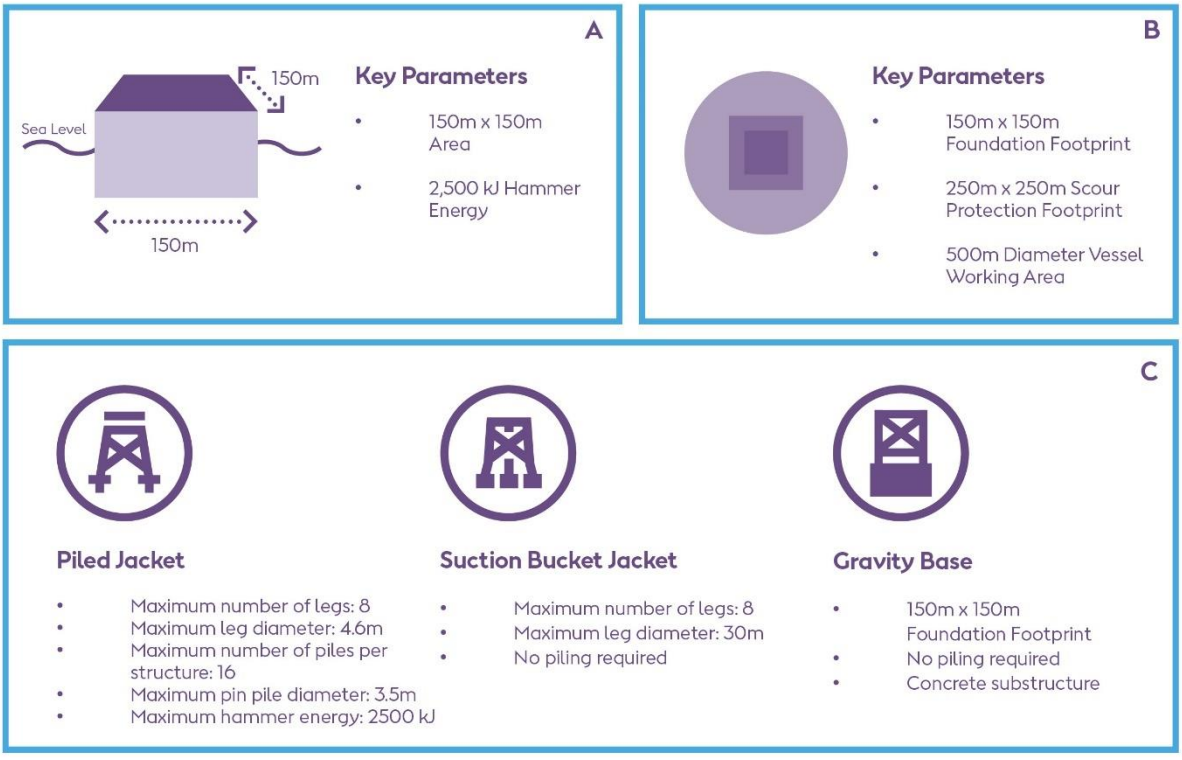


Figure 3-5: Overview of Offshore Substation and Offshore Accommodation Platform Foundations

3.3.4.6 Insets A and B in Figure 3-5 are schematics presenting the maximum design scenario for all offshore substation and offshore accommodation platform foundation types shown in inset C.

- Inset A. All offshore substation and offshore accommodation platform foundations (maximum of 15) fit within the 150 x 150 m worst-case area (seabed and sea-level) and require a maximum 2,500 kJ piling energy for installation in the case of jacket foundations.
- Inset B. All offshore substation and offshore accommodation platform foundations have a maximum seabed footprint of 150 x 150 m, a 250 x 250 m scour protection footprint and a 500 m temporary works area for construction vessels.
- Inset C. All offshore substation and offshore accommodation platform foundation types considered within the Hornsea Four Design Envelope.

3.4 Electrical Infrastructure

3.4.1 Overview

3.4.1.1 The Hornsea Four electrical transmission system will likely consist of several offshore and onshore cables and substations, as outlined in Table 3-4. The transmission system will collect and transport the power produced at the wind turbines on to the UK electricity transmission network. Although the transmission system will be constructed by the Applicant, ownership will be transferred to an Offshore Transmission Operator (OFTO) after Hornsea Four is constructed in a transaction overseen by The Office of Gas & Electricity Markets (OFGEM), the Government regulator for gas and electricity markets.

Table 3-4 Maximum Design Scenario: Electrical Infrastructure

Package	Parameter	Design envelope
Offshore cables	Number of array cables	One per wind turbine plus potential redundant links
	Number of interconnector cables	One per substation and accommodation platform
	Number of export cables	6 (one per circuit) within a 1.5km cable corridor
	Cable burial depth	To be determined via 'Cable Burial Assessment Report'
	Cable installation seabed preparation	Boulder clearance, sandwave clearance
	Cable installation methodology	Trenching, dredging, jetting, ploughing, vertical injection

Package	Parameter	Design envelope
Offshore substations topside	Number	13 Wind farm Array Area 3 Export Cable Corridor (Not Simultaneously)
	Length of topside	180 m
	Width of topside	90 m
	Height (excluding helideck or lightning protection) (LAT)	100 m
	Installation methodology	Transport barge with crane vessel to lift in place; alternatives such as skidding also under consideration
Offshore booster substations subsea structure	Number	6 (one per circuit)
	Subsea structure: length	30 m
	Subsea structure: width	30 m
	Subsea structure: height	15 m
	Installation methodology	Crane vessel or float out; piled or other method as per substation foundations
Landfall	Horizontal Directional Drill (HDD)	8 (one per circuit, plus 2 spare)
	Transition Joint Bay (TJB)	6 (one per circuit)
Onshore cables	Number	18 (three per HVAC circuit)
	Trenches	6 (one per circuit)
	Installation	Direct-lay in trenches, or pulled through pre-installed ducting
	Permanent corridor	60 m
	Temporary construction corridor	80 m
Onshore substation	Area of site	Site specific; indicatively 160,000m^2 including energy balancing with 100,000m^2 temporary area for construction
	Number of main buildings	1 – 5
	Height of main building	30 m

3.4.2 HVAC Booster Station(s)

3.4.2.1 If required, the HVAC booster station(s) will be located offshore, along the export cable route, and could be located above the sea surface or on the seabed. If an above sea surface design is chosen, the substation will be similar to the substations within the offshore wind farm. If a subsea design is chosen, the electrical plant will be protected within structures permanently attached to the seabed, as in Figure 3-5.

3.4.3 Onshore Electrical Export Cable(s)

3.4.3.1 The indicative onshore cable arrangement is illustrated in a typical trench cross-section in Figure 3-6. Cable installation is a well-established technique and incorporates environmental management and mitigation measures as standard practice. Precise installation methods will differ according to the nature of the environment through which the cable is being installed. Most of the cable route will be constructed using the spread method of cable construction. It has been designed to create the most cost effective and least environmentally damaging approach to cable construction.

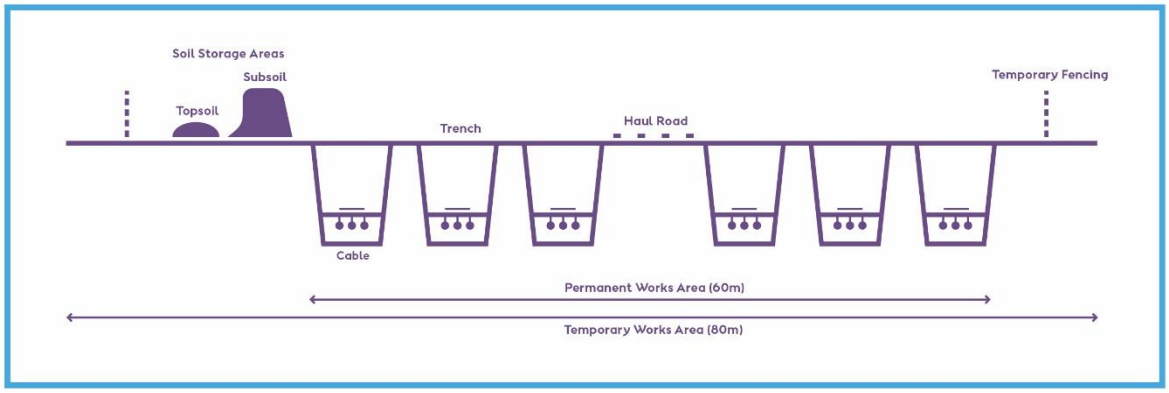


Figure 3-6 Typical Cross-Section of Onshore Cable Route Corridor (not to scale)

3.4.3.2 As well as the typical cross-section of cables, a transition jointing bay (TJB) and jointing bays (JB) are required. A TJB is an underground concrete structure holding the joint between the offshore and onshore export cables, while a jointing bay is an underground concrete structure holding the joint between sections of the onshore export cables. The exact location of the TJB and number of JBs will be determined via the EIA process and communicated in the PEIR if possible to do so. If not the number and location will be communicated in the final ES.

3.4.3.3 All cables will be installed by one or a combination of open-cut and horizontal directional drill (HDD). HDD is a trenchless method where cable is directly pulled in to pre-drilled underground section

3.4.4 Onshore Substation

3.4.4.1 The onshore substation contains the electrical components for transforming the power supplied from the wind farm to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid. If a HVDC system is used it will also house equipment to convert the power from HVDC to HVAC. The equipment will either be housed within a single or multiple building(s), in an open yard or a combination of the above.

3.4.4.2 The maximum design scenario will be set out in the PEIR (e.g. max height, footprint, number and type of buildings).

3.4.5 Energy Balancing Equipment

3.4.5.1 Energy balancing equipment is becoming increasingly widespread to effectively and cost-efficiently balance the supply and demand of electricity within the electrical transmission network and thus increase the overall reliability of the system. Since this is a rapidly evolving technology, a range of technologies are under development and hence will be considered and assessed within the ES. The system could be housed in single or multiple building(s), several containers, in an open yard or a combination of the above.

3.4.5.2 All energy balancing equipment will be housed wholly within the footprint of the onshore substation as defined at PEIR.

3.5 Construction Programme

3.5.1.1 The indicative high-level construction programme shown in Figure 3-7 provides an overview of installation durations of the main project elements. The programme assumes that Hornsea Four will be built out to its full extent in a single construction campaign.

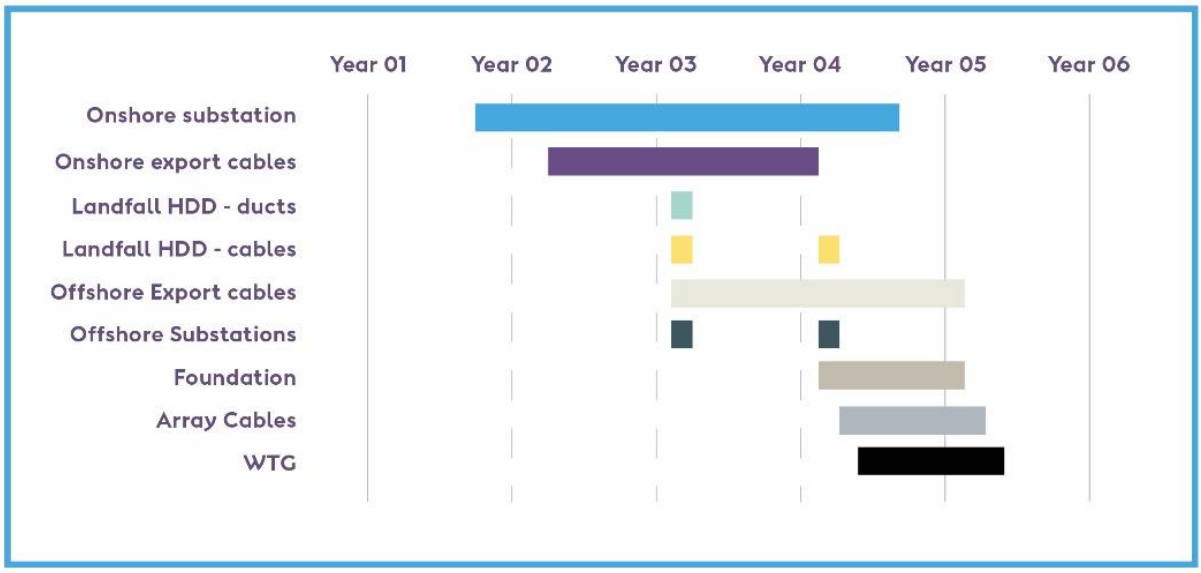


Figure 3-7: Indicative Construction Programme

3.6 Operations, Maintenance and Decommissioning Phases

3.6.1.1 The overall operations and maintenance (O&M) strategy will be finalised once the onshore base location and technical specification are known, including wind turbine type, electrical transmission design and final project layout. The O&M strategy could include either an onshore O&M base (which would be an existing facility or consented separately under local planning regulations), an offshore O&M base (accommodation platforms), or both. The general O&M strategy will rely primarily on crew vessels, offshore accommodation, supply vessels, and helicopters for the O&M services that will be performed at the windfarm.

3.6.1.2 Maintenance activities will be categorised into two levels: preventive and corrective maintenance. Preventive maintenance will be undertaken according to scheduled services whereas corrective maintenance would be needed to cover unexpected repairs, component replacements, retrofit campaigns and breakdowns.

3.6.1.3 At the end of the operational lifetime of the windfarm it is anticipated all offshore structures above the seabed (foundations and electrical infrastructure) will be completely removed and the site of the onshore substation will be restored. All electrical cables swill be left in-situ to minimise environmental impacts associated with their removal. The decommissioning sequence will take approximately three years and will generally be the reverse of the construction sequence, involving similar types and numbers of vessels and equipment. The decommissioning plan and programme will be developed prior to construction and be updated during the project's lifespan to take account of changing best-practice and new technologies.

4 Site Selection and Consideration of Options

4.1 Introduction

4.1.1.1 It is noted that Schedule 4 (paragraph 2) of the 2017 EIA Regulations require developers to outline how chosen options have been selected and the reasonable alternatives considered by the Applicant. The EIA will set out the options considered for Hornsea Four and the main reasons for selecting particular options, taking into consideration environmental effects, technical feasibility and the overall objectives of the project. In addition the EIA will also consider a 'no development option' which will outline the likely evolution of the baseline scenario without implementation of the development.

4.1.1.2 This chapter presents a summary of the process followed for route planning and site selection (RPSS) that is being followed by Hornsea Four. The PEIR and ES will provide further detail on the RPSS work including how the design, routes and locations have evolved over time and any refinements that take place specifically as a result of the EIA process and in response to stakeholder feedback.

4.2 AfL and Grid Connection

4.2.1.1 Factors influencing site selection for electricity transmission networks are summarised in Section 2.2 of NPS EN-5. In particular *"the general location of an electricity network project is determined by the location of a particular generating station and the existing network infrastructure available to take electricity to centres of energy use" (NPS EN-5, paragraph 2.2.2).* In the context of Hornsea Four, the two end points are defined as the AfL and the National Grid connection point.

4.2.1.2 The background to the former Hornsea Zone is described in **section 1.2.1**. Four potential projects were identified within the former zone by SMart Wind and Hornsea Four is the last of those projects to be developed. Hornsea Four array area will be developed within the AfL.

4.2.1.3 A number of potential grid connection locations were discussed with National Grid. However, the grid connection offer was made solely at the discretion of National Grid and the Applicant therefore has not considered other options.

4.3 Electrical Infrastructure Study Area

4.3.1.1 An Electrical Infrastructure Study Area (EISA) was defined and used as an initial search area for the RPSS work. The EISA used the locations of the AfL and Creyke Beck as its eastern and western boundaries. The northern extent of the onshore part of the EISA runs from Creyke Beck to just north of Barmston, and the southern extent runs from Creyke Beck to just north of Holmpton to avoid the environmental designations at Spurn Head and the Humber Estuary. The northern and southern extents of the offshore part of the EISA are straight lines drawn from the northern and southern corners of the AfL to shore. The EISA is shown in the inset of **Figure 4-2**.

4.4 Landfall Location

4.4.1.1 The landfall search area included the coastal stretch within the EISA (see Figure 4-2). The search area was sub-divided into a series of zones. Zones that backed on to residential or recreational areas were removed from consideration at an early stage. The remaining zones were visited and rated against Black, Red, Amber and Green (BRAG) criteria (see Figure 4-1 below).

4.4.1.2 A decision was made to avoid the Holderness Inshore Marine Conservation Zone (MCZ) removing all zones that were located outside the current scoping boundary from consideration. Avoidance of the MCZ was adopted as a commitment for Hornsea Four (Co44 of the Commitments Register, Annex B). Further detail on mitigation and commitments is provided in section 5.4.5. As a consequence, the landfall search area was limited to the coastal stretch from south of Barmston to the northern extent of the MCZ. The sequential process that was followed for landfall selection including the avoidance of the MCZ is illustrated in Figure 4-2.

Identification of suitable options for the landfall, onshore substation, and onshore and offshore export cable corridors each followed a similar process

1. A search area was defined for which constraints data were collected.

2. A number of options that avoided key constraints were identified within the search area based on project requirements (e.g. land requirement, corridor width). Site visits were undertaken for the onshore components to provide additional data.

3. The teams within Ørsted (i.e. Environment and Consents, Land and Property, Commercial, Technical and Electrical Installation) developed selection criteria for a Black, Red, Amber and Green (BRAG) appraisal to be undertaken in order to rank the options, with options ranked from most preferred to least preferred.

The BRAG ratings were defined as follows:

- Black Potential showstoppers to development.
- Red High potential for the development to be constrained.
- Amber Intermediate potential for the development to be constrained.
- Green Low potential for the development to be constrained.

Black and red constraints are critical in determining features that should be avoided wherever possible to avoid consenting risk, reduce EIA complexity and reduce the cost of mitigation. Hornsea Four has subsequently made commitments based on the avoidance of features that were rated as black and red constraints (e.g. national and international environmental designations). These commitments are set out in the Commitments Register (see section 5.4.5 and Annex B) and Hornsea Four will continue to identify where commitments can be made to avoid constraints based on the RPSS work in order to reduce project risk and deliver a proportionate EIA.

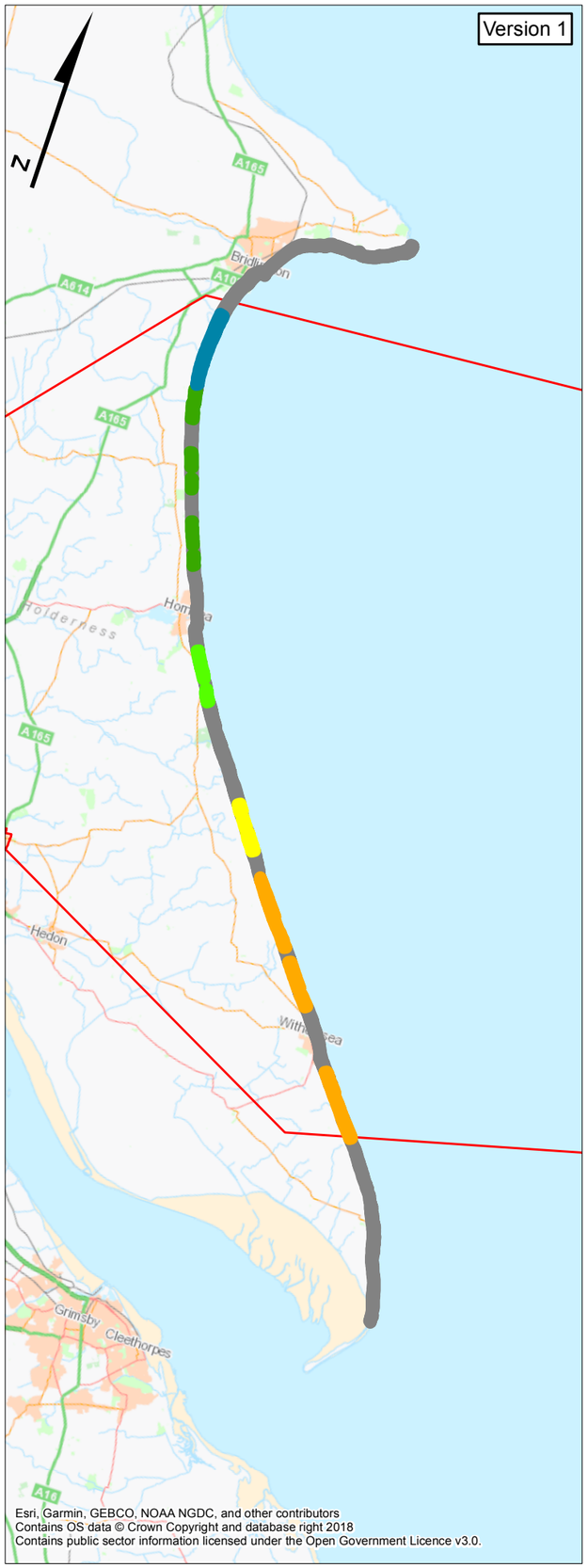
Amber and green constraints are those that may be more readily minimised or managed by employing appropriate mitigation measures. Based on the BRAG appraisal the number of options were reduced. The remaining options will continue to be reduced as preferred options and alternatives are identified and refined for the PEIR and ES.

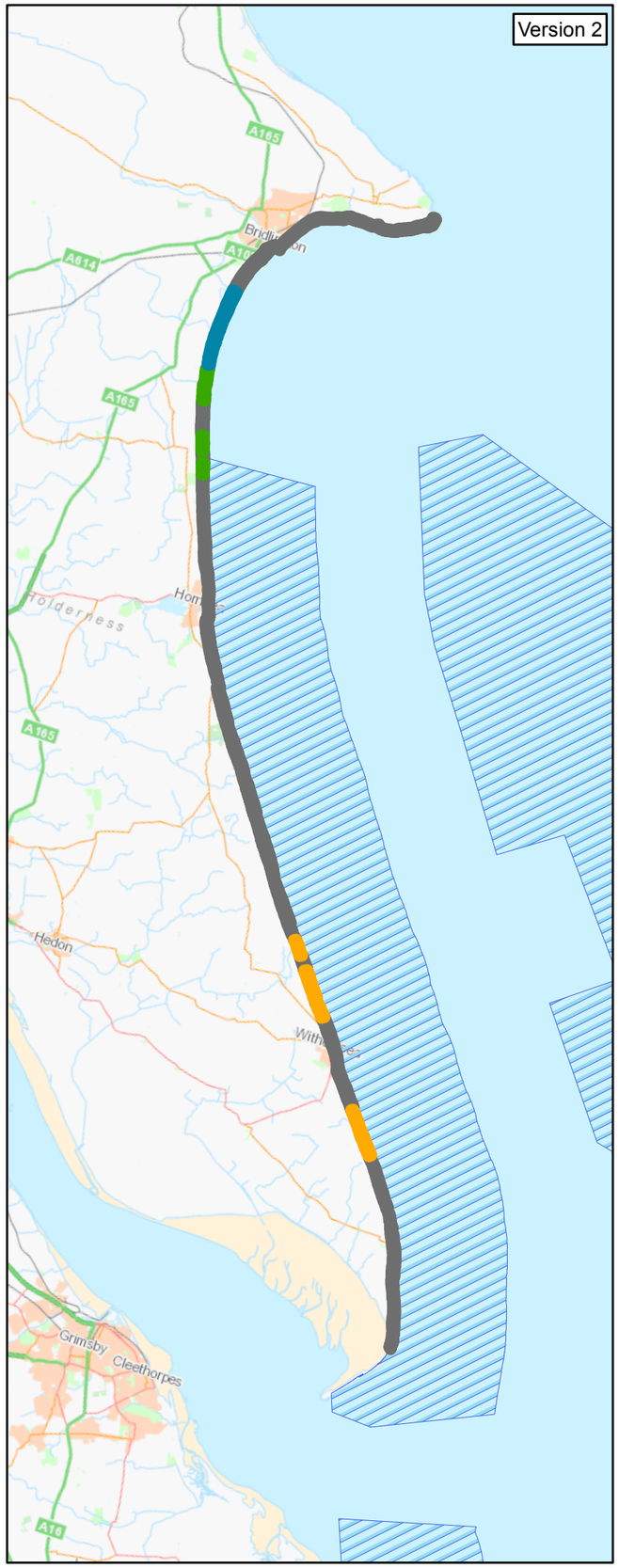
Figure 4-1: Route Planning and Site Selection Methodology

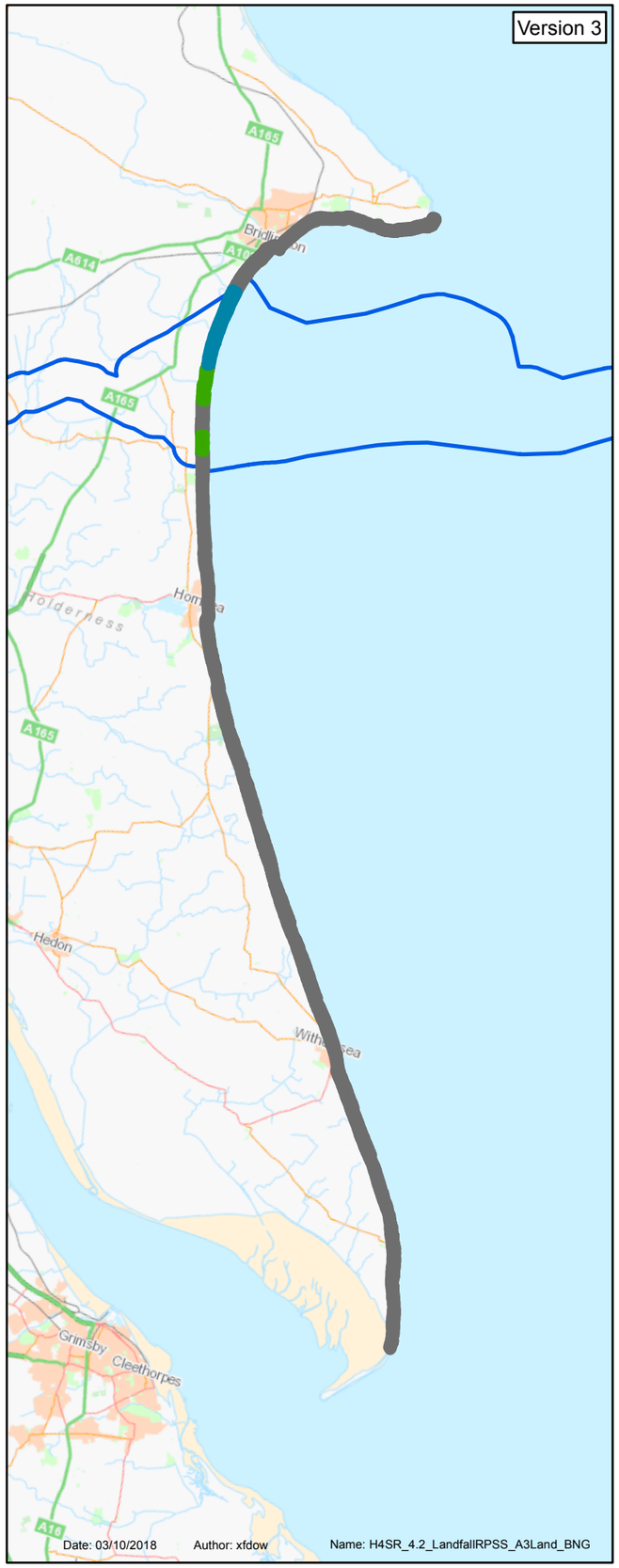
Hornsea Project Four

Landfall - Route Planning and Site Selection

Figure 4.2







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Date: 03/10/2018 Author: xfdow Name: H4SR_4.2_LandfallRPSS_A3Land_BNG

Version 1

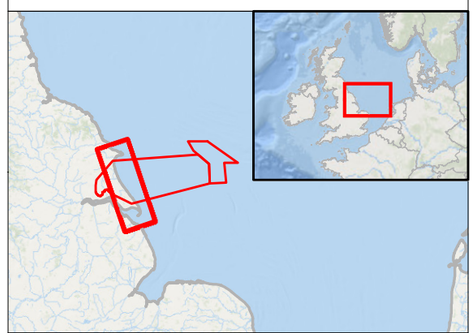
- Landfall Zone A
- Landfall Zone B
- Landfall Zone C
- Landfall Zone D
- Landfall Zone E
- Landfall Not Suitable
- Electrical Infrastructure Study Area

Version 2

- Landfall Zone A
- Landfall Zone B
- Landfall Zone E
- Landfall Not Suitable
- Marine Conservation Zone

Version 3

- Scoping Boundary
- Landfall Zone A
- Landfall Zone B
- Landfall Not Suitable



Coordinate system: British National Grid

Scale@A3: 1:300,000

0 5 10 15 Kilometers

0 2 4 6 8 10 Miles

Landfall - Route Planning and Site Selection
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Approved by: JULCA

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4.5 Onshore Substation Site

4.5.1.1 An area of 3 km radius was applied to Creyke Beck to limit the search for a suitable onshore substation site to an area as close as reasonably practicable to the grid connection offer location. The search area was then amended to remove heavily constrained areas (e.g. settlements and other highly or more populated areas including Beverley and Cottingham). The area to the east of Hull – Scarborough railway line was removed from the search area when the eastern electrical cable route was discounted due to the fact that no suitable crossing point on the Woodmansey Road could be identified that satisfied the Applicant's search and technical criteria. Refinement of the onshore substation search area is illustrated in **Figure 4-3**. The next step is to identify suitably sized land parcels within the search area as onshore substation site options for these to then be rated against BRAG criteria to be included as part of the PEIR.

4.6 Onshore and Offshore Export Cable Corridors (ECC)

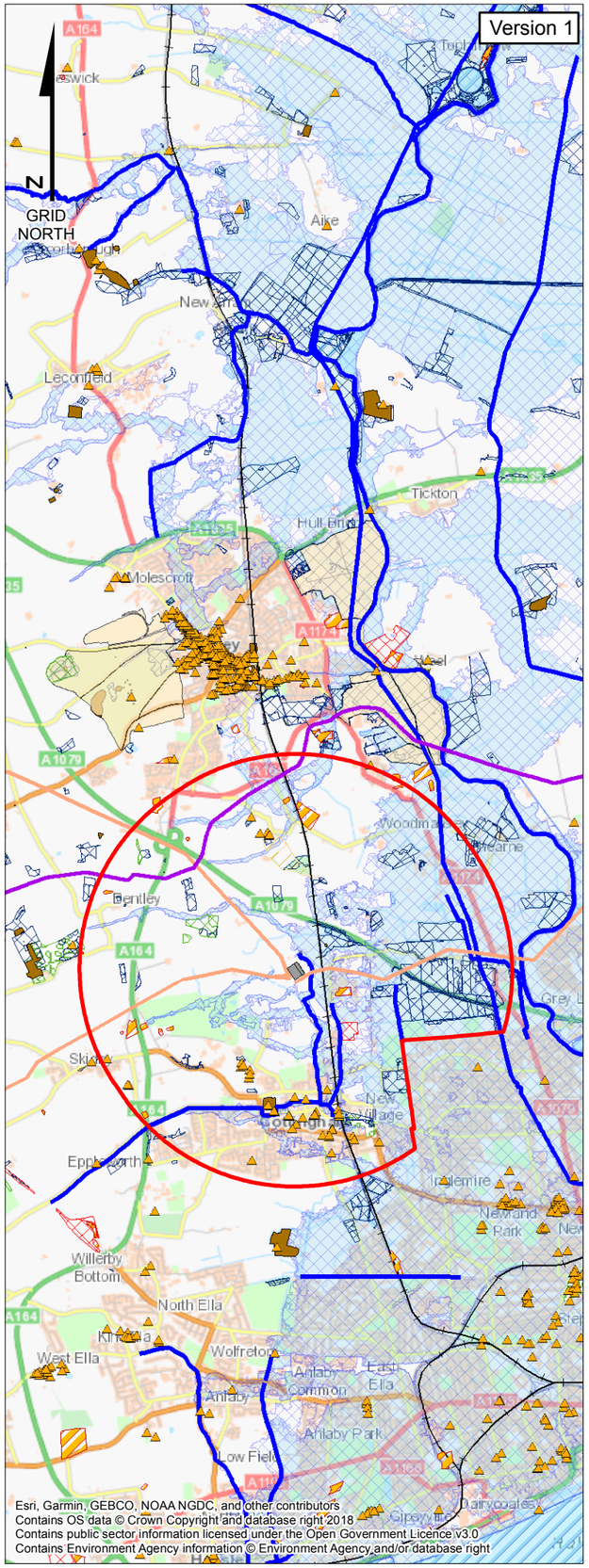
4.6.1 Onshore Export Cable Corridors

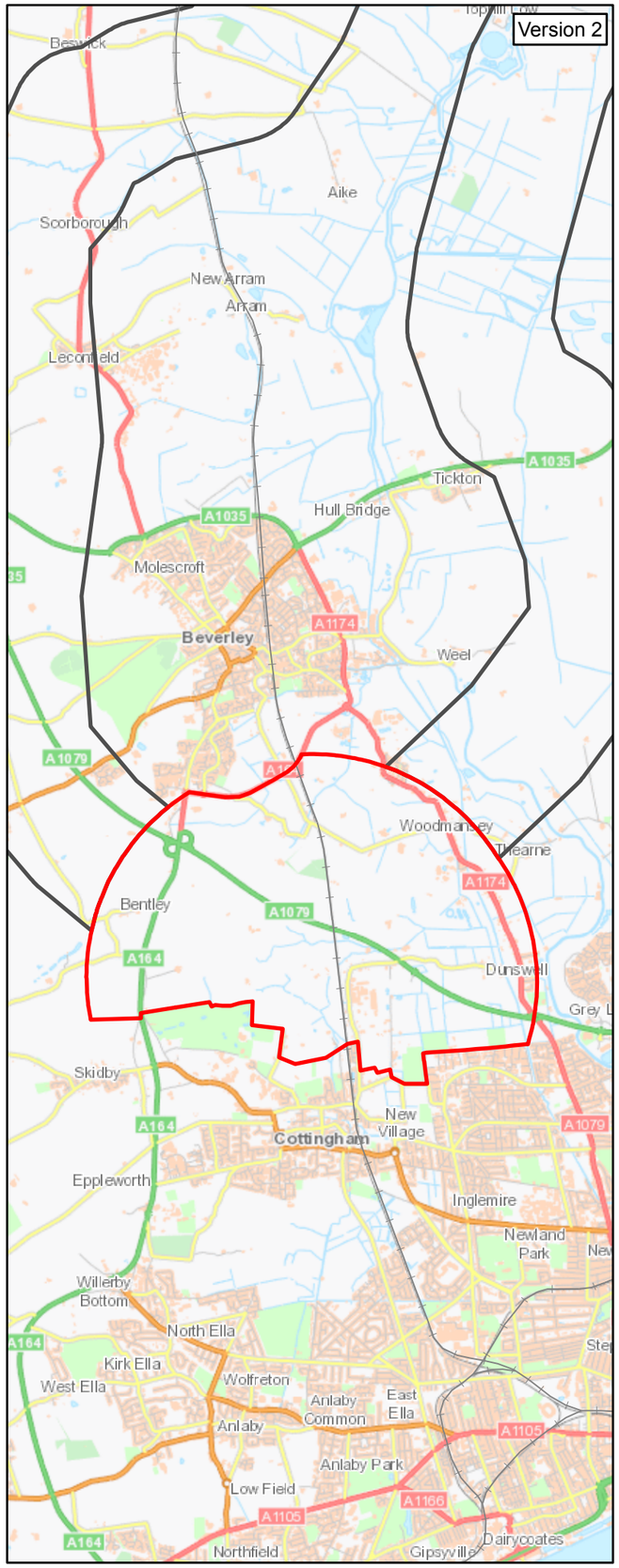
4.6.1.1 The Onshore ECC options started as straight lines from the potential landfall locations to Creyke Beck. **Figure 4-4** illustrates an example of mapping constraints, application of buffer zones based on the BRAG criteria and how the initial straight line route options were rerouted to avoid black and red constraints and minimise the length of traversal through areas of amber constraints. Following this rerouting, avoidance of constraints became commitments of the project. Once a centreline was established, 200 m and 700 m buffer areas were applied to represent the indicative permanent and temporary areas for the purposes of seeking a Scoping Opinion.

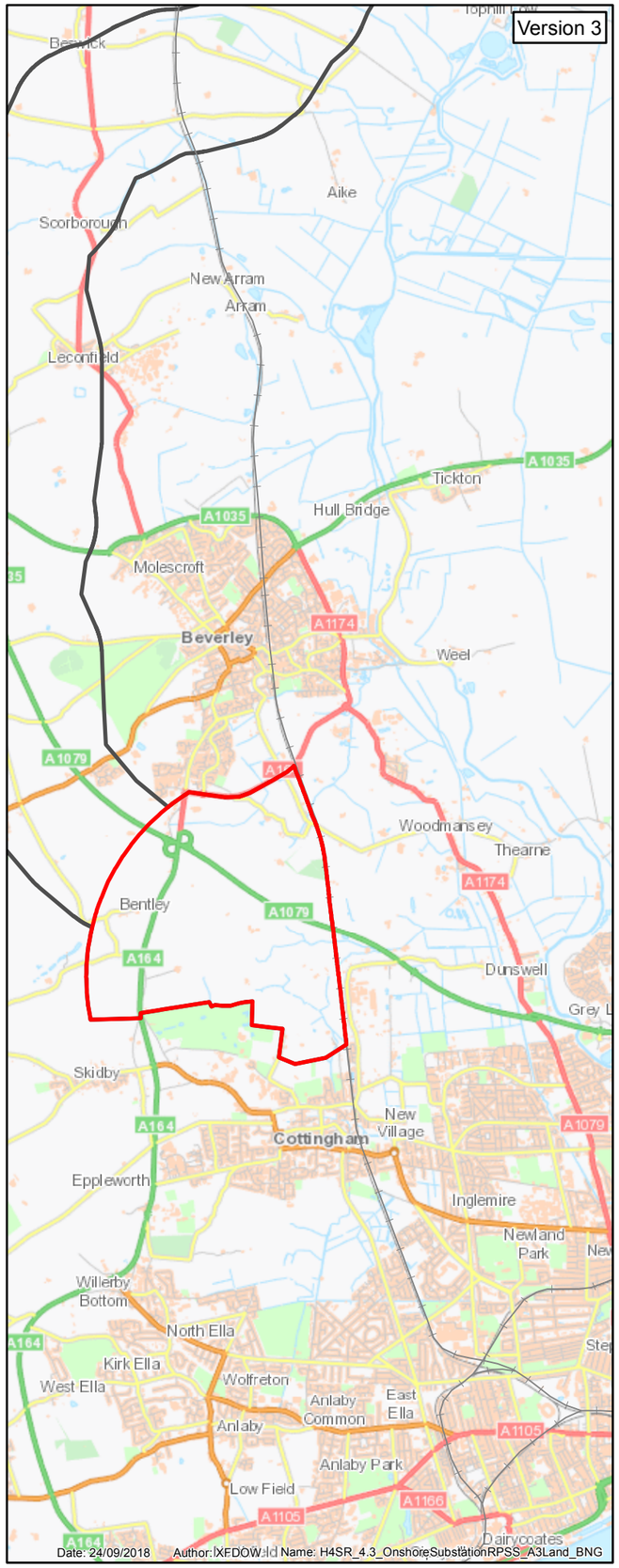
4.6.2 Offshore Export Cable Corridors

4.6.2.1 Similar to the onshore ECCs, the offshore ECCs started as straight lines connecting the AfL to the potential landfall locations. **Figure 4-5** illustrates an example of how the straight line route options were rerouted to avoid buffered black and red constraints and minimise the length of traversal through areas of amber constraints. Avoidance of these constraints became commitments of the project. Similarly to the onshore ECC, once a centreline had been established 2,000 m and 3,000 m buffer areas were applied to represent the indicative permanent cable area and temporary works area for the purposes of seeking a Scoping Opinion. The biggest influence on the route of the offshore ECC was the decision to avoid the Holderness Inshore MCZ (Co33, **Annex B**) and the Holderness Offshore recommended MCZ (rMCZ)(Co45, **Annex B**)

Hornsea Project Four
Onshore Substation - Route Planning and Site Selection
Figure 4.3



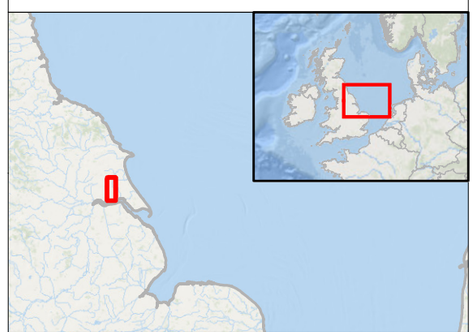




Version 1
- Substation Search Area Version 1
- Creyke Beck
- Listed Building
- Main River
- National Grid Gas Pipeline
- National Grid Overhead Line
- Ancient Woodland
- Authorised Landfill Site
- Flood Zone 2
- Flood Zone 3
- Historic Landfill
- Local Nature Reserve
- Priority Habitat
- Registered Common Land
- Registered Park and Garden
- Scheduled Monument
- Site of Special Scientific Interest
- Special Protection Area

Version 2
- Substation Search Area Version 2
- Indicative Cable Corridor

Version 3
- Substation Search Area Version 3
- Indicative Cable Corridor



Coordinate system: British National Grid

Scale@A3: 1:80,000

0 1 2 3 4 Kilometers

0 1 2 Miles

Onshore Substation - Route Planning and Site Selection
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Version 1

N
GRID NORTH

Version 2

Version 2 with Buffers

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Hornsea Project Four

Onshore Export Cable - Route Planning and Site Selection

Figure 4.4

Version 1

- Indicative Export Cable Route (Version 1)
- Building
- Priority Habitat - Deciduous woodland
- Red BRAG Criteria
- Amber BRAG Criteria

Version 2

- Indicative Export Cable Route (Version 1)
- Indicative Export Cable Route (Version 2)
- Building
- Priority Habitat - Deciduous Woodland
- Red BRAG Criteria
- Amber BRAG Criteria

Version 2 with Buffers

- Indicative Export Cable Route (Version 2)
- Indicative Permanent Cable Area (200m)
- Indicative Temporary Works Area (700m)
- Building
- Priority Habitat - Deciduous woodland



Coordinate system: British National Grid

Scale@A3: 1:10000

0 100 200 300 400 500 Metres

0 0.1 0.2 0.3 Miles

Onshore Export Cable - Route Planning and Site Selection
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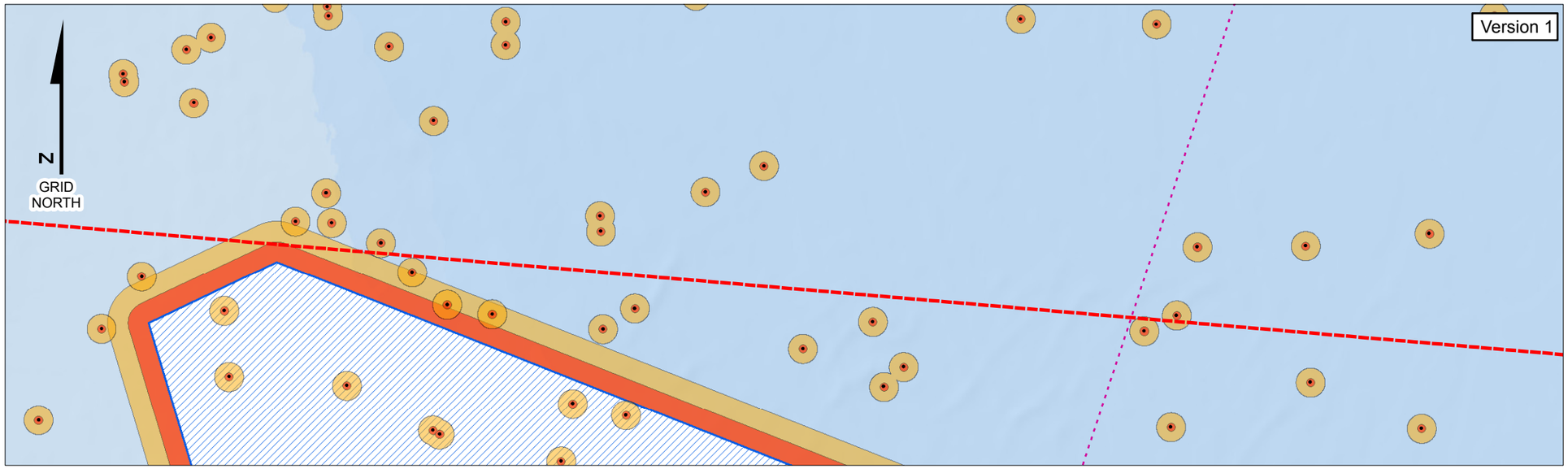
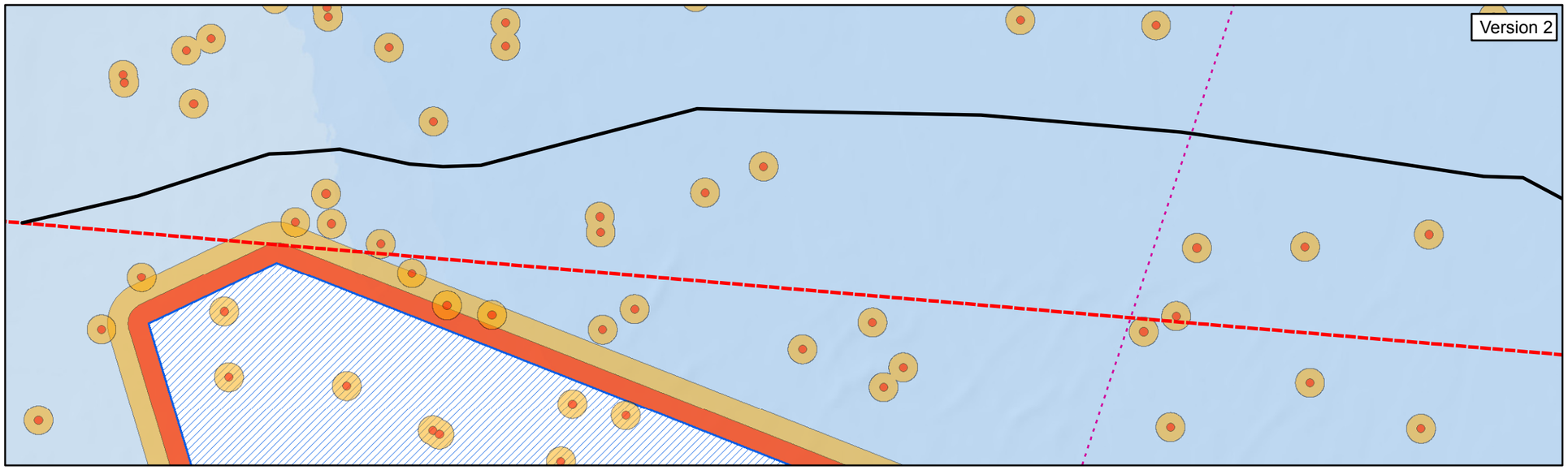
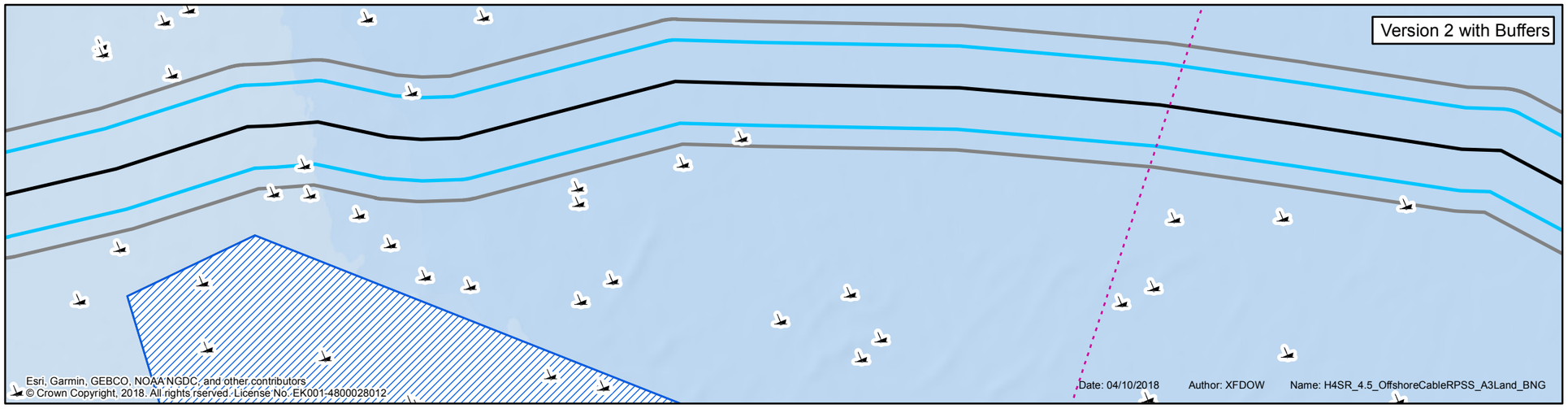






Hornsea Project Four

Offshore Export Cable - Route Planning and Site Selection

Figure 4.5

Version 1

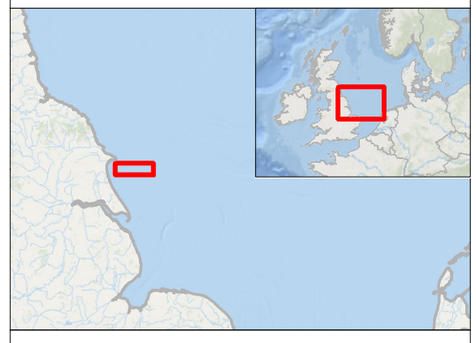
- Indicative Export Cable Route (Version 1)
- Pipeline
- Marine Conservation Zone
- Red BRAG Criteria
- Amber BRAG Criteria

Version 2

- Indicative Export Cable Route (Version 1)
- Indicative Export Cable Route (Version 2)
- Pipeline
- Marine Conservation Zone
- Red BRAG Criteria
- Amber BRAG Criteria

Version 2 with Buffers

- Indicative Export Cable Route (Version 2)
- Indicative Permanent Cable Area (2000m)
- Indicative Temporary Works Area (3000m)
- Wreck
- Pipeline
- Marine Conservation Zone



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:120000

0 1 2 3 4 5 Kilometres

0 1 2 3 Nautical Miles

Offshore Export Cable - Route Planning and Site Selection
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4.7 Refinement and Next Steps

4.7.1.1 The scoping boundary presented in this Scoping Report is a composite of the search areas adopted at this stage in design and RPSS development to identify the location of the landfall, onshore substation, permanent cable area and temporary works corridor, and within which they may all be moved or deviated. As design and RPSS development continues, the number of options, areas and width of the corridors will reduce. This incremental process is set out in **Table 4-1** and the concept is illustrated for the onshore ECC in **Figure 4-6**.

Table 4-1 Refinement of Design and RPSS Development

Stage	Description
Scoping	Onshore ECC: • Indicative Permanent Cable Area (200 m): the area at this stage in design development within which the final 80 m working width for the cable is planned to be located. • Indicative Temporary Works (700 m): the area at this stage in design development within which temporary works (e.g. construction, HDD and storage compounds) are planned to be located and within which the 200 m Permanent Cable Area may be deviated. Onshore Scoping Boundary (2,000 m): the search area adopted at this stage in design development to identify the Permanent Cable Area and Temporary Works corridors and within which the Permanent and Temporary Cable Areas may be deviated. Offshore Scoping Boundary (3,000 m): the search area adopted at this stage in design development to identify the offshore export cable route and temporary works area and the area within which they may be deviated.
PEIR	Onshore ECC: • Indicative Permanent Cable Area (100 m): the area at the PEIR stage in design development within which the 60 m working width for the cable is planned to be located. • Indicative Temporary Works (200 m): the area at the PEIR stage in design development within which temporary works (e.g. construction, HDD and/or storage compounds) are planned to be located and within which the 100 m Permanent Cable Area may be deviated. • Indicative Access: Area required for access (temporary or permanent) to the construction and/or operation and maintenance activities. Located within the 2,000m Scoping area. Onshore substation: preferred and alternative site within the onshore substation search area. Landfall: preferred and alternative site within the landfall search area. Offshore ECC (1,500 m): the area at the PEIR stage in design development within which the offshore export cable route and temporary works area are planned to be located. Located within the 3,000 m offshore scoping area.

Stage	Description
DCO Application	Onshore ECC: • Permanent Cable Area (60 m): Area for all permanent (electrical cables and TJBs) and temporary (soil storage and construction haul road) • Compound: construction, HDD and/or storage compounds outside of the permanent cable corridor for auxiliary works. • Access: Area required for access (temporary or permanent) to the construction and/or operation and maintenance activities. Located within the 2,000m Scoping area. Onshore substation: preferred site within the onshore substation search area. Landfall: preferred site within the landfall search area. Offshore ECC (1,000 m): the area within which the export cable route and temporary works area are planned to be located. Located within the 3,000 m offshore scoping area.

Figure 4-6 illustrates how the temporary work area (700 m) will be used to locate indicative logistics areas and permanent and temporary access to the ECC. The indicative logistics areas will be refined to an indicative logistics compound for the PEIR and further refined for the DCO application. This may involve changes to the location of the logistic compound site as design matures (e.g. following discussions with land owners). However, any changes to the location will remain within the initial temporary work area (700 m). Indicative HDD compounds will be located within the PEIR temporary work area (200 m) as part of the DCO application.

Scoping

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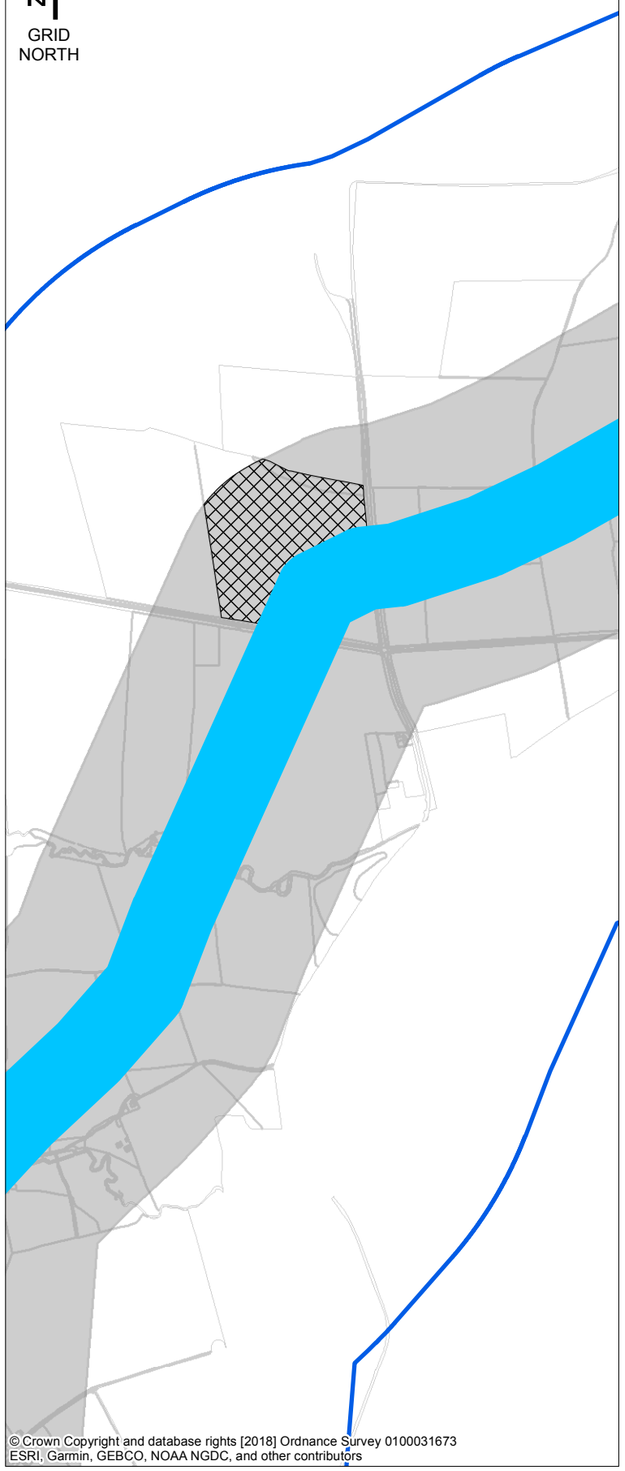

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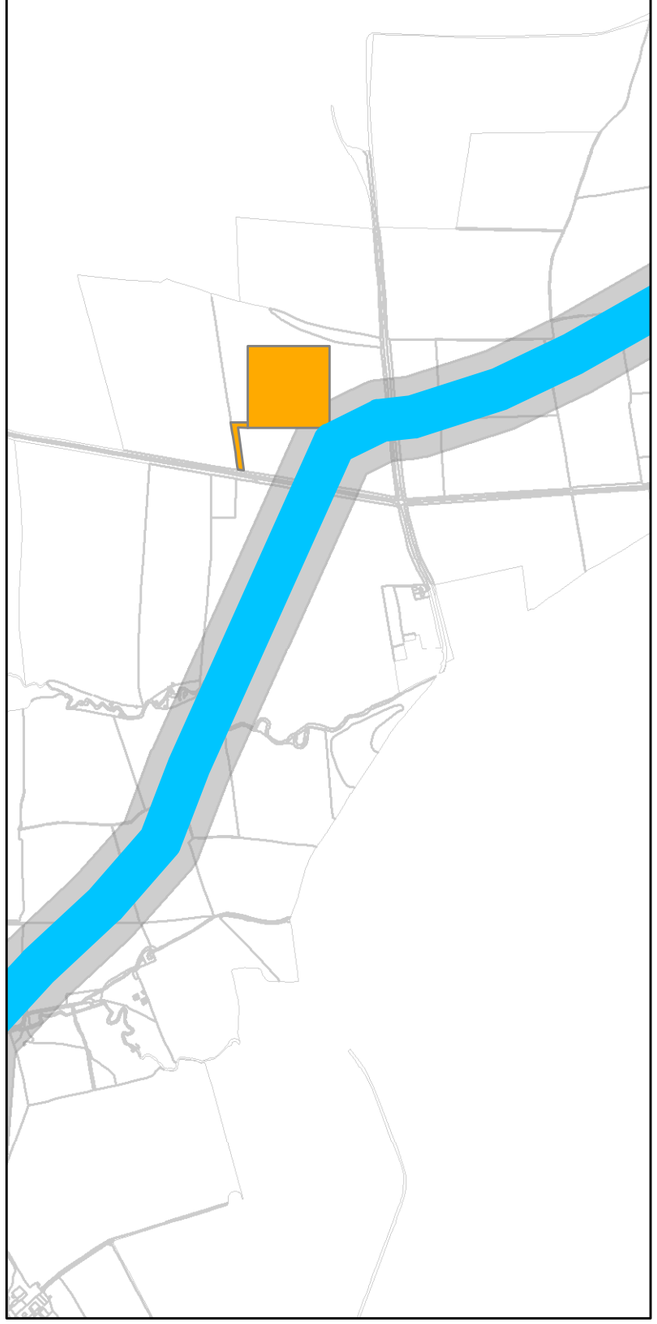
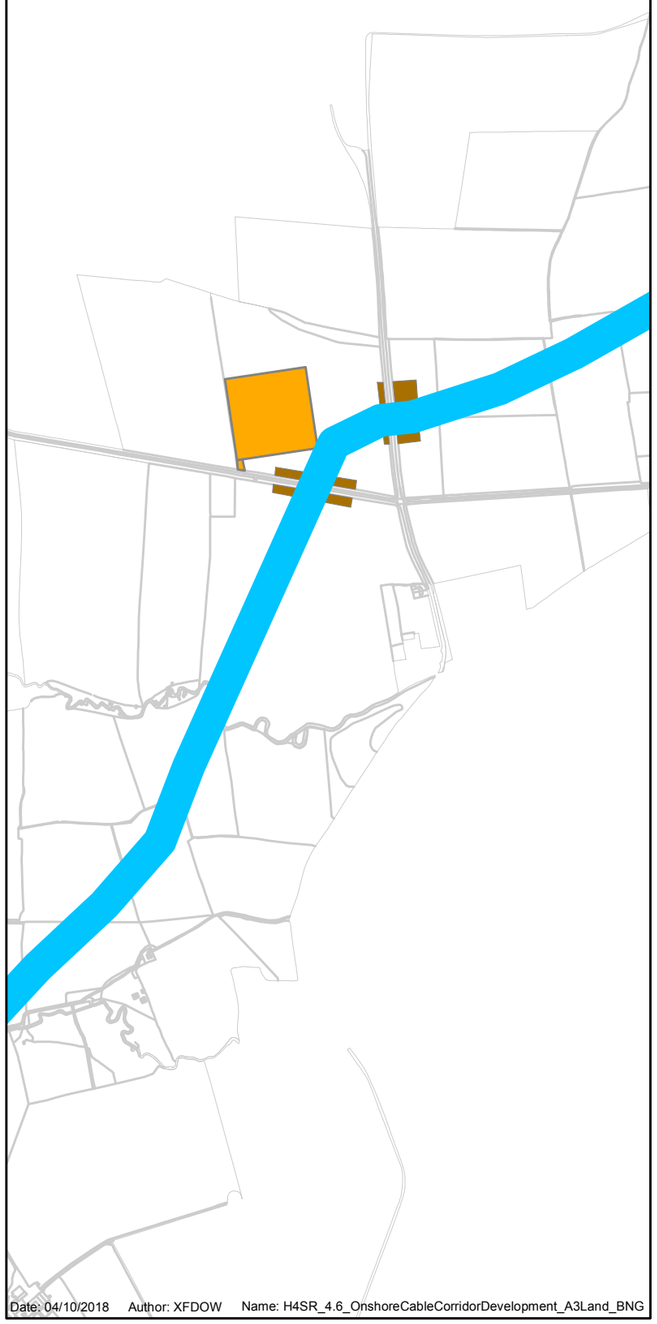
PEIR



DCO Application



Date: 04/10/2018 Author: XFDOW Name: H4SR_4.6_OnshoreCableCorridorDevelopment_A3Land_BNG

Hornsea Project Four
Onshore Cable Corridor Development
Figure 4.6

Scoping
- Scoping Boundary (2000m)
- Indicative Permanent Cable Area (200m)
- Indicative Temporary Works (700m)
- Indicative Potential Logistics Area

PEIR
- Indicative Permanent Cable Area (100m)
- Indicative Temporary Works (200m)
- Indicative Logistics Compound

DCO Application
- Indicative Permanent Cable Area (80m)
- Indicative Logistics Compound
- Indicative HDD Compound



Coordinate system: British National Grid

Scale@A3: 1:15000

0 200 400 600 800 Meters

0 0.1 0.2 0.3 0.4 0.5 Miles

Onshore Cable Corridor Development
Document No: H4SR_4.6
Created by: XFDOW
Checked by: KIEBE
Approved by: JULCA

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5 EIA Methodology

5.1 Introduction

5.1.1.1 This chapter describes the broad principles of the methodology that will be adopted for the Hornsea Four EIA. It describes the approach that will be used to identify, evaluate and mitigate potential likely significant environmental effects and the tools that have been used to deliver proportionality in this process (e.g. the Impacts Register, see **section 5.4**). It also sets out the proposed temporal, spatial and technical scope of the EIA.

5.2 Key EIA Regulations, Policy and Guidance

5.2.1.1 EIA is a procedure required under the terms of Directive 2011/92/EU, as amended by Directive 2014/52/EU on assessment of the effects of certain public and private projects on the environment.

5.2.1.2 Article 1(1) of the Directive (as amended) sets the focus of EIA on the assessment of the environmental effects of those public and private projects *"which are likely to have significant effects on the environment"*. Article 2(1) of the Directive states that:

"Member States shall adopt all measures necessary to ensure that, before development consent is given, projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location are made subject to a requirement for development consent and an assessment with regard to their effects on the environment."

5.2.1.3 Article 3 and Article 8, respectively, also states that:

"...in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 12, the direct and indirect significant effects of a project..."
"The results of consultations and information gathered pursuant to (the EIA procedure) shall be duly taken into account in the development consent procedure".

5.2.1.4 The 2017 EIA Regulations implement the EIA Directive (as amended) in England for NSIPs.

5.2.1.5 Matters relevant to the EIA process and topics to be addressed are also identified in UK Government policy, including sector-specific National Policy Statements (NPS): Overarching NPS for Energy (NPS EN-1) (DECC, 2011); NPS for Renewable Energy Infrastructure (NPS EN-3) (DECC, 2011); and NPS for Electricity Networks Infrastructure (NPS EN-5) (DECC, 2011);

5.2.1.6 In addition to the directive, regulations and relevant policy, the EIA will be undertaken with reference to the following documents (plus topic-specific guidance referenced in subsequent sections of this Scoping Report), amongst others:

- Advice Note Three (version 7), EIA Consultation and Notification, Planning Inspectorate, August 2017;

- Advice Note Seven (version 6), Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements, Planning Inspectorate, December 2017;
- Advice Note Nine (version 3), Rochdale Envelope, Planning Inspectorate, July 2018;
- Advice Note Ten (version 8): Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects, November 2017;
- Advice Note Eleven(version 4): Working with public bodies in the infrastructure planning process, Planning Inspectorate, November 2017;
- Advice Note Twelve (version 5): Transboundary Impacts and Process, Planning Inspectorate, March 2018;
- Advice Note Seventeen (version 1), Cumulative effects assessment relevant to nationally significant infrastructure projects, Planning Inspectorate, December 2015;
- Advice Note Eighteen (version 1): The Water Framework Directive, Planning Inspectorate, June 2017;
- Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of Food and Environment Protection Act 1985 and Coastal Protection Act 1949 requirements (CEFAS, 2004);
- Cumulative Impact Assessment Guidelines - Guiding Principles For Cumulative Impact Assessment in Offshore Wind Farms (RenewableUK, 2013);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (CEFAS, 2012);
- Guidelines for Environmental Impact Assessment, IEMA, 2004;
- Guide to Shaping Quality Development, IEMA 2015; and
- Delivering Proportionate EIA, A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice, IEMA 2017.

5.2.1.7 A full account of applicable legislation and guidance taken into account within the EIA methodology will be documented within the PEIR and ES.

5.3 Approach to the EIA

5.3.1 General Approach

5.3.1.1 The purpose of the EIA process and its resultant documentation is to inform the SoS (and PINS, who will examine the application and make a recommendation as to whether to grant consent) and to provide a source of information for stakeholders, regarding the likely significant effects associated with the development during its construction, operation and maintenance, and decommissioning.

5.3.1.2 The likely significant effects of Hornsea Four will be identified for each relevant EIA topic. This will be done by comparing baseline environmental conditions (i.e. the current state of the environment without Hornsea Four) with the conditions that would prevail were Hornsea Four constructed and operated. The significance of these changes will be assessed against such matters as the possible breach of a limit or capacity of the natural environment to absorb the resultant effect.

5.3.1.3 Effects will be assessed in relation to environmental receptors, that is: people (e.g. residents of buildings, users of facilities, employees of businesses), built resources (e.g. listed buildings) and natural resources (e.g. sites of ecological importance, protected species).

5.3.1.4 The overall EIA approach is shown in **Figure 5-1**. While **Figure 5-1** provides a general framework for identifying impacts and assessing the significance of their effect(s), in practice the approaches and criteria applied across different environmental and socio-economic topics vary. **Chapters 6** and **7** outline the proposed approaches to the technical topics that will be addressed in the EIA.

5.3.1.5 The remainder of this chapter introduces the approaches to key aspects of the EIA.

5.3.2 Proportionate EIA Approach

5.3.2.1 As noted by the Institute of Environmental Management and Assessment (IEMA, 2017), delivering proportionate EIA is a key issue for the UK planning and consenting system and developers seeking to take projects forward. IEMA go on to acknowledge that:

"Delivering proportionate assessment cannot be achieved without significant improvements to the way scoping operates in UK EIA practice. The understanding of scoping must evolve from a stage in the assessment to a core process running throughout an EIA, which presents ongoing opportunities to define and redefine what information is of value and how it to make it accessible to different stakeholders."

5.3.2.2 Adopting this IEMA guidance, delivering proportionate EIA for Hornsea Four will be a progressive activity that has started with scoping, and will proceed through the Evidence Plan process and consultation and present the outcome in the PEIR and ES. The approach and tools used to deliver a proportionate approach in the EIA are described in **section 5.4**.

Identify Impact

The scoping process identifies the potentially most important/significant impacts and effects (including secondary, indirect and cumulative) for the assessment to address. This is done through a combination of:

- looking at the nature of the project activities and the impacts they will give rise to;
- looking at the project's environmental and social setting and those aspects which are likely to be most sensitive/ vulnerable to impacts from the project;
- applying professional understanding gained from the evidence base; and
- considering inputs from stakeholders through consultation.

Decisions will then be made on which impacts and effects to

Predict Magnitude

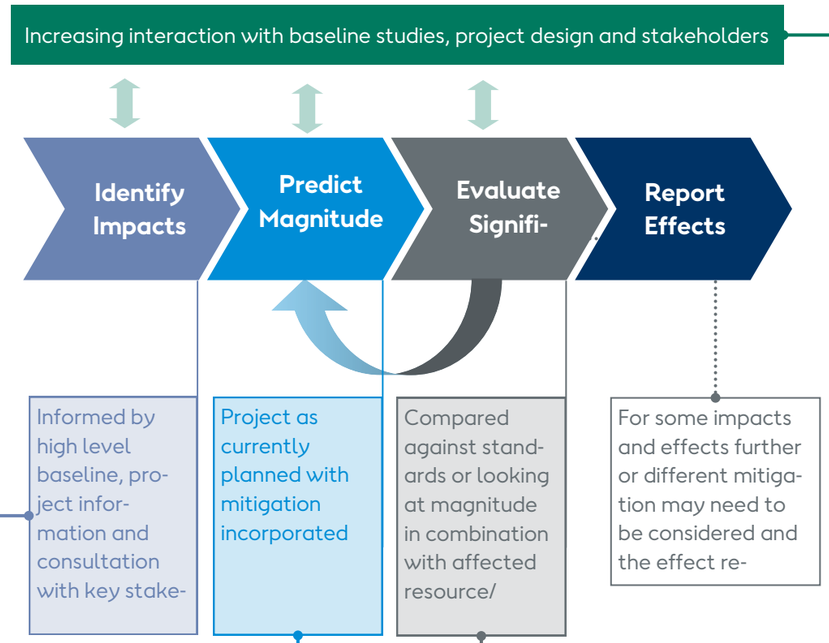
The project's impacts will be quantified in terms of such matters as:

- land take area or habitat loss;
- proportion of an ecological population exposed to impact;
- change in noise levels or pollution at a receptor; and
- numbers of jobs generated in the local economy.

In predicting magnitude, the effect of all the project mitigation in place (i.e. adopted by Ørsted) will be taken into account.

For some impacts, especially noise, air and water pollution, significance can be assessed directly against numerical criteria and standards. For exceedances, further mitigation must be incorporated by the project to reduce the magnitude of the impact (and the significance of its effect).

For other impacts nominal levels of magnitude (e.g. small, medium, large) may be adopted based on widely recognised factors such as: the nature of a change (what is affected and how); its size, scale or intensity; its geographical extent



Describe Baseline

Baseline data will be collected to better understand the potentially most important impacts and effects identified in scoping. Baseline data may quantify existing exposure levels (e.g. for noise, air and water pollution), identify vulnerable populations of animals or people, more clearly delineate valued cultural property and ecosystem services etc.

Where a baseline aspect cannot be quantified then nominal levels of importance, quality or value (low, medium, high) will be assigned based on widely accepted criteria in fields such as ecology, cultural heritage, landscape and socioeconomic assessment. Inter-relationships between elements of the baseline will be identified.

Interact with Project Design

The EIA process will interact with the project design team to develop a basis for the assessment (for example quantities of emissions, noise levels of equipment, sizes of structures). The EIA process will also interact with design to assess optimal mitigation options, especially when after initial assessment some impacts may need to be further reduced.

Evaluate Significance

In evaluating significance, the EIA process seeks to inform regulators and stakeholders about the effects of Hornsea Four in a way that helps them make decisions on whether to approve and allows them to develop suitable conditions to attach to an approval. The evaluation of significance should ideally demonstrate legal compliance at least (e.g. compliance with quantified standards, avoidance of effects on legally protected resources).

In the absence of quantified standards, significance can be evaluated through considering the magnitude of an impact in combination with the importance/quality/value of the receptor or resource that is affected, also considering the response (or sensitivity) of a resource or a receptor to a particular impact. Effects of more than minor significance may warrant re-examination to see if an impact magnitude can be reduced further. Different mitigation options may be examined and the reasons for selecting one and rejecting others explained. Some impacts/effects that cannot be adequately mitigated may need to be addressed through the consideration of offsets or compensation.

		Magnitude of Impact/Degree of Change			
		Negligible	**Minor**	**Moderate**	**Major**
Value, Importance, Sensitivity	**Low**	Not Significant	Not Significant or Minor (Not Significant)	Minor (Not Significant)	Minor (Not Significant) or Moderate (Significant)
	Medium	Not Significant	Minor (Not Significant)	Moderate (Significant)	Moderate (Significant) or Major (Significant)
	High	Not Significant	Minor (Not Significant) or Moderate (Significant)	Moderate (Significant) or Major (Significant)	Major (Significant) or Substantial (Significant)
	Very High	Not Significant	Moderate (Significant) or Major (Significant)	Major (Significant) or Substantial (Significant)	Substantial (Significant)

While the above provides a general framework for identifying impacts and assessing the significance of their effects, in practice the approaches and criteria applied across different environmental and socio-economic topics vary.

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Figure 5-1: General Approach to the EIA

5.4 Proportionate Approach to Scoping

5.4.1 Overview

5.4.1.1 A number of approaches have been adopted for Hornsea Four that are aimed at delivering a proportionate EIA:

- route planning and site selection (**Chapter 4** and **section 5.4.2**);
- the impacts register (**section 5.4.4**, **Annex A**);
- capitalising on the existing evidence base (**section 5.4.4**);
- early adoption of mitigation and the commitments register (**section 5.4.5, Annex B**); and
- a tiered approach to define an appropriate level of assessment (**section 5.4.6**).

5.4.1.2 One key aspect of the approach to scoping is the initial identification of the likely significant effects of Hornsea Four. This initial assessment of likely significance is supported by a combination of:

- knowledge acquired by the EIA team on baseline conditions at this stage;
- definition of the project up to this point;
- national policy and standards;
- the evidence base and experience of similar projects passing through the consenting system;
- topic-specific criteria for impact magnitude, receptor sensitivity to impacts and significance of effect; and
- the professional judgement of experts.

5.4.1.3 In general a reasonable degree of confidence in the identification of likely significance effects in this scoping report can be drawn from the wealth of baseline data already available and the general consensus on the main impacts and effects of projects like Hornsea Four.

5.4.2 Route Planning and Site Selection

5.4.2.1 Route planning and site selection is described in **Chapter 4**. In addition to designing a technically feasible project, RPSS aims to avoid or reduce impacts by committing to avoid the most sensitive, important or valuable features early in project design and in so doing reducing the scope of the Hornsea Four EIA and the amount of assessment required. An example of how this has been applied is illustrated in **Figure 4-4**. The commitments that have been made through the RPSS process are included in the Commitments Register (**Annex B**).

5.4.3 The Impacts Register

5.4.3.1 A cornerstone of the approach to delivering proportionate EIA is the development of an impacts and effects register (the 'impacts register'). The purpose of the impacts register is to:

- detail all the potential impacts for Hornsea Four;
- adopt a systematic approach to the identification of impacts and effects, and to then take this approach forward and develop it further during scoping and thereafter in the PEIR and ES;

- define the baseline data required to inform impact assessment;
- provide a high-level impact assessment (magnitude, sensitivity and significance);
- detail the appropriate level of EIA (referred to as 'tiered approach', see section 5.4.6);
- list mitigation measures embedded in or committed to in design, and those additional mitigation options identified in the EIA process requiring sign-off by Hornsea Four, to reduce effects; and
- act as a consultation tool which will be communicated to all stakeholders at Scoping, LEI, PEIR and DCO.

5.4.3.2 The Impacts Register is an Excel spreadsheet comprising the columns described in Table 5-1. The Impacts Register allows the user to sort and filter the impacts and effects that are most relevant to them. For example, it can be filtered to only show impacts that will occur during construction or those related specifically to the installation of the onshore export cable. The Impacts Register will be disclosed to stakeholders at scoping (as part of this report and consultation events), PEIR and ES. An extract of the register is included in each of the topic sections and the full document is included as Annex A. It should be noted that the Impacts Register included in Annex A is a snapshot in time and for the purposes of establishing the impacts identified at the scoping stage. The actual Impacts Register is a live document and will be updated on an iterative basis.

5.4.3.3 As a consultation tool stakeholders will be able to review the impacts included in the register and agree the level of assessment that is proposed.

Table 5-1 Impacts Register Contents

Column title	Content
Reference	Sets a unique reference number for each impact.
Project element	Sets the project element to which the impact relates. For onshore, the options are landfall, cable route corridor, onshore substation or all onshore project elements
Project phase	Sets the project phase relevant to each impact i.e. construction, operation & maintenance, and decommissioning.
Impact description	Describes the change that occurs in the environment as a result of a project activity and results in an impact.
Embedded mitigation measures	Describe the mitigation inherent in the design, include design measure, construction method and management plan
Magnitude rankings	Sets the expected magnitude of the impact, applying topic-specific criteria (no change, negligible, small, medium or large).
Magnitude justification	Provides a brief justification for the chosen magnitude ranking.
Importance / sensitivity ranking	Sets the importance/sensitivity of the receptor derived from topic-specific criteria (negligible, low, medium, high).
Importance /sensitivity justification	Provides a brief description / justification for the importance/sensitivity ranking

Column title	Content
Likely significance of effect	Traffic light: • Green: not significant or of minor significance (scoped out); • Amber: likely significant effects (simple assessment approach); or • Red: likely significant effects (detailed assessment approach)
Baseline data requirements	Briefly describes the baseline data requirements to inform assessment.

5.4.4 Evidence Base

5.4.4.1 Hornsea Four is located within the former Hornsea Zone, for which large volumes of existing data and knowledge regarding the baseline environment are available from the previous three Hornsea projects, as well as from other sources. The Hornsea Four EIA, including this scoping stage, will maximise the use of these data and related assessments, in order to:

- characterise the baseline environment to inform the EIA where data are suitable to do so;
- scope out certain matters from further assessment where there is a clear evidence basis in order to avoid duplication of assessment; and
- where certain matters are scoped in, draw upon the evidence base and previous impact assessment work where appropriate.

5.4.4.2 The topic sections of this Scoping Report identify where the evidence base has been drawn upon for scoping and where it will continue to be drawn on to inform the EIA. Where relevant, each topic section of this Scoping Report sets out the following.

- The data that have already been obtained and the role of existing and publicly available data sources in defining the baseline environment for Hornsea Four.

- Where this scoping process has identified a requirement, a description of additional data that will be collected in order to inform the Hornsea Four EIA.

5.4.4.3 As part of the pre-application consultation process for certain key topics, the nature of the existing baseline data, its sufficiency for the Hornsea Four EIA and any requirements for further data collection are currently being discussed with the relevant consultees as part of the Evidence Plan Process (see section 5.6.5).

5.4.5 Adopted Mitigation and the Commitments Register

5.4.5.1 For each topic the EIA process has systematically identified impacts and effects and taken into consideration mitigation measures that Hornsea Four has already adopted. These mitigation measures include both avoidance, best practice and design commitments, which are classified into primary or tertiary measures in accordance with the IEMA 'Guide to Shaping Quality Development' (2015) definitions.

- Primary (inherent) mitigation: are measures that form an intrinsic part of the design that are described in the design evolution narrative and included within the project description e.g. reducing development heights to reduce visual impact.

- Secondary (foreseeable) mitigation: those measures that require further activity in order to achieve the anticipated outcome, e.g. development of the optimal reinstatement measures for restoring a disturbed sensitive natural habitat.

- Tertiary (inexorable): are measures which will be required regardless of the EIA process as they are imposed e.g. as a result of legislative requirements and/or standard industry practices (e.g. via a Construction Environmental Management Plan (CEMP), Code of Construction Practice (CoCP) or similar).

5.4.5.2 As advocated in the IEMA Guidance (2015) 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 EIA team has considered mitigation measures that Hornsea Four has committed to adopt in making an initial assessment of the likely significant effects. A number of offshore wind farms and cable connections have been built and are operating in UK waters and many more have passed and are passing through the consenting processes. As a result, effective mitigation measures (usually 'primary' and 'tertiary') for most of the impacts associated with offshore wind developments are well-developed and widely-accepted.

5.4.5.3 While Hornsea Four will need to develop further mitigation measures (mainly 'secondary') to address certain site and area-specific conditions and sensitivities, there are also many measures that Hornsea Four can confidently adopt from the outset of the EIA process. These measures are described in **Chapters 6** and **7** together with the evidence base for impacts (e.g. drawing from the 'Industry Evidence Programme for Proportionate Impact Assessment' which is specific to offshore wind EIAs).

5.4.5.4 Once they are agreed by Hornsea Four, all commitments are recorded in the Commitments Register (**Annex B**) that is maintained as an Excel spreadsheet. The contents of the Commitments Register is set out in **Table 5-2**.

Table 5-2 Commitments Register Contents

Column title	Content
Reference	Sets a unique reference number for each commitment.
Project element	Sets the project element to which the impact relates. For onshore, the options are landfall, cable route corridor, onshore substation or all onshore project elements
Activity	Sets the project phase relevant to each impact i.e. construction, operation & maintenance, and decommissioning.
Project stage / commitment priority	Sets the stage of the project that the commitment has been agreed (e.g. RPSS, Scoping)
Commitment	Describes the commitment in full.
Onshore topic relevance	Check box against the onshore topics to which the commitment is relevant.
Offshore topic relevance	Check box against the offshore topics to which the commitment is relevant.
Classification	Classification of the commitment against the IEMA mitigation classification (i.e. primary, secondary or tertiary).
Where is the approved commitment secured	Sets out how the commitment is secured (e.g. it is a requirement for the CoCP and DCO)

5.4.6 Tiered Approach

5.4.6.1 As a result of the above approaches adopted for the EIA scoping stage some matters can be justifiably scoped out of any further assessment additional to that presented in this Scoping Report; other matters can be assigned with an appropriate level of assessment methodology (broadly 'simple' or 'detailed') as part of a tiered approach to EIA. This process begins within the Impacts Register, which assigns provisional levels for assessment for each impact which are then tested in further in the scoping process. Under each topic this Scoping Report sets out the following.

- Effects that are judged to be not significant and which will be 'scoped out of further assessment' in the EIA. The evidence basis for this judgement, together with embedded mitigation is set out.

- Likely significant effects that the applicant proposes be addressed through a 'simple assessment' approach in the PEIR and ES. What comprises a 'simple assessment' for that topic/effect is defined and may typically relate to secondary baseline data acquisition (e.g. desk and literature based) and assessment method (e.g. qualitative).

- Likely significant effects that the applicant proposes be addressed through a 'detailed assessment' approach in the PEIR and ES. The approach (baseline data collection, impact analysis methods etc.) are defined for each topic/effect and may typically include primary data acquisition by survey or series of surveys and assessment methods that are based on quantifying impacts e.g. through modelling.

5.4.6.2 Scoping the Hornsea Four EIA maximises the use of the evidence base and professional judgement. There are many sources of monitoring data, that show many predictive assessment methods to be overly conservative, and these sources are used to inform EIA scoping. IEMA specifically references the 'Industry Evidence Programme for Proportionate Impact Assessment' which is specific to offshore wind EIAs (see e.g. Industry Evidence Programme Offshore Wind Farms - Pilot Industry Evidence Base June 2018, The Crown Estate, IEMA, Royal Haskoning DHV. The findings of the programme to date have developed summaries for 14 offshore wind farm EIA topics. It should be noted that the findings are a work in progress and represent the knowledge that was drawn together as part of a pilot. Many of the findings suggest recommendations that could improve practice, reduce costs, improve efficiency and promote proportionate assessment.

5.5 Impacts, Effects, Mitigation and Significance

5.5.1.1 Taking account of the IEMA EIA Quality Mark Article[1], 'Impacts' are defined as the physical (and 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).

5.5.1.2 As noted in **Figure 5-1**, for many topics the likely significance of an effect is established by combining the magnitude of an impact with the sensitivity of the receiving environmental resource or receptor to that particular impact (sensitivity is not considered as an inherent characteristic but how something specifically responds to an external factor). The importance or value of a resource or receptor is also considered.

[1] https://transform.iema.net/article/impacts-and-effects-do-we-really-understand-difference

5.5.1.3 As set out in various widely used methodologies (e.g. Design Manual for Roads and Bridges (DMRB), Highways Agency 2009 and PD 6900:2015 Environmental impact assessment for offshore renewable energy projects – Guide, BSI 2015), the majority of technical topics will assess the likely significance of an effects as follows.

- The level of effect will be determined by considering the magnitude of an impact together with the importance and value of an affected resource or receptor and its sensitivity to the impact. (see Figure 5-2).
- A level of effect of moderate or more will generally be considered a 'significant' effect. A level of effect of minor or less will be considered 'not significant'.

		Magnitude of Impact/Degree of Change			
		Negligible	**Minor**	**Moderate**	**Major**
Value, Importance, Sensitivity	**Low**	Not Significant	Not Significant or Minor (Not Significant)	Minor (Not Significant)	Minor (Not Significant) or Moderate (Significant)
	Medium	Not Significant	Minor (Not Significant)	Moderate (Significant)	Moderate (Significant) or Major (Significant)
	High	Not Significant	Minor (Not Significant) or Moderate (Significant)	Moderate (Significant) or Major (Significant)	Major (Significant) or Substantial (Significant)
	Very High	Not Significant	Moderate (Significant) or Major (Significant)	Major (Significant) or Substantial (Significant)	Substantial (Significant)

Figure 5-2 Deriving the Level of Effect and its Significance

5.5.1.4 The matrix is based on the DMRB methodology as modified in the Hornsea Three ES (EN010080-000530-HOW03_6.1.5_Volume 1 - Ch 5 - Environmental Impact Assessment Methodology). Further modifications have been introduced in the interest of proportionate assessment and in accordance with guidance presented in BSI 2015 such that:

- a magnitude of impact of 'no change' is not assessed since it will always lead to a not significant effect;
- a negligible magnitude impact is not considered further since it will always lead to a not significant effect; and
- resources and receptors of negligible importance, value or sensitivity are not considered further since any magnitude of impact on them would not lead to a significant effect.

5.5.1.5 For some topics, significance is established by simply comparing the magnitude of an impact with a quantified standard. In this instance the quantified standard is in turn based on a level at which recognised effects are triggered (e.g. sleep disturbance for noise). Topic specific methodologies that will be followed during the EIA are included in Annex C.

5.5.1.6 Mitigation measures are developed to avoid, minimise, reduce or remedy (e.g. reinstate or restore) any negative effects identified, and to create or enhance positive effects such as environmental and social benefits. These are applied based on a hierarchy illustrated in

Figure 5-3. In this context, mitigation measures are taken to include design measures (primary mitigation) and construction practices, as well as management actions (both secondary and tertiary mitigation). In some instances mitigation alone may not be sufficient to reduce an impact or effect to a not significant level and other measures such as offsets (which can also deliver enhancement) are then considered (an example of secondary mitigation).

5.5.1.7 Once mitigation measures are agreed they become commitments of Hornsea Four. However, it is good practice to consider mitigation measures iteratively with design in the form of a hierarchy where avoidance is the primary objective and offset is a last resort. Although an offset may provide enhancement, enhancement in itself is different, typically adding something positive in accordance with local or national policy. Enhancement is not mitigation.

5.5.1.8 Residual effects, once mitigation measures have been applied, will be classified as not significant or still significant (albeit reduced), as appropriate. Where effects are still significant, the mitigation options considered and the reasons for selecting particular measures will be reported in the PEIR and ES.

5.5.1.9 The degree of significance attributed to residual effects is related to the weight the EIA team considers should be given to them in making decisions on the Project and, where appropriate, the application of DCO requirements and other conditions.

5.5.1.10 Effects of moderate significance or above are considered important to decision making, warranting careful attention to ensure conditions regarding mitigation and monitoring employ the most appropriate (technically feasible and cost-effective) measures.

5.5.1.11 Effects of minor significance or less are or may be brought to the attention/ of decision-makers but will typically be identified as warranting little if any weight in the decision; mitigation will typically be achieved using normal good practice, e.g. for construction. Some topic guidance designates effects of minor significance as being 'not significant' in the context of the 2017 Regulations. In order to deliver a proportionate EIA this approach has been adopted for the Impacts Register (see **section 5.4.3**, **Annex A**) and the tiered approach for assessment (see **section 5.4.6**).

5.5.1.12 Where concerns remain over the significance of residual effects and there is no scope to reduce the significance of the effect through practicable mitigation measures aimed directly at the impact then the EIA will consider and present ways to offset the effect.

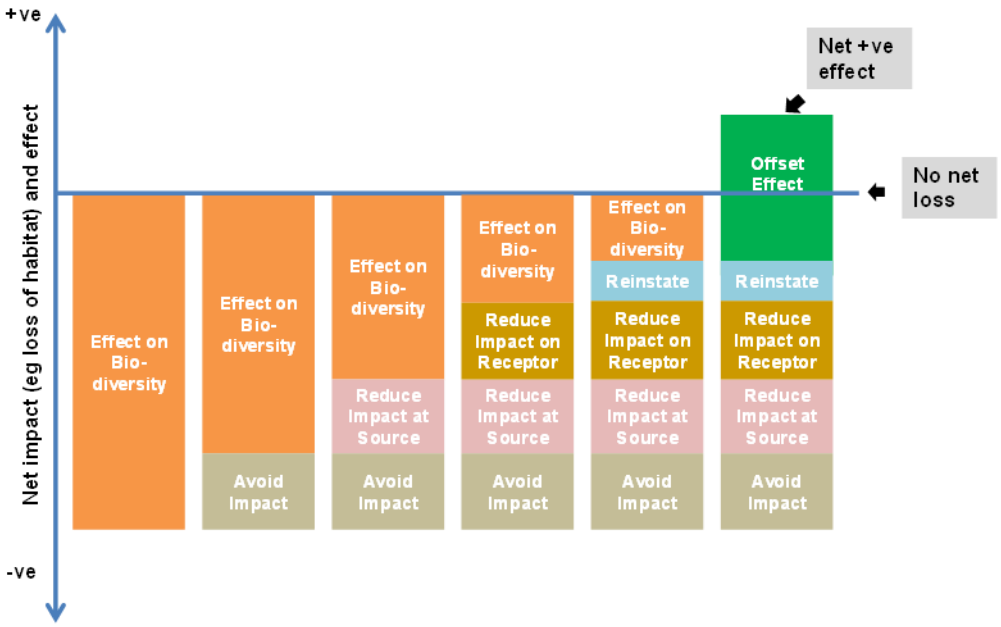


Figure 5-3 Mitigation Hierarchy

5.5.1.13 For effects that are initially assessed to be of major significance a design change (primary mitigation) is usually implemented to avoid, minimise or reduce these, followed by a reassessment of significance. For effects initially assessed to be of moderate significance, specific mitigation measures such as engineering controls or construction methods (secondary and tertiary mitigation) are usually considered to reduce the impacts and their effects to levels as low as reasonably practicable. This approach takes into account the technical and financial feasibility of mitigation measures. Effects assessed to be of minor significance are usually managed through the implementation of management plans, good industry practice, operational plans and procedures.

5.5.1.14 EIA is intended to ensure that decisions on projects are made in full knowledge of their likely effects on the environment and society. The residual effects and their significance reported in the PEIR and ES will be based on Hornsea Four as planned and designed fully inclusive of all proposed mitigation.

5.5.1.15 The mitigation measures developed during the EIA process (secondary mitigation), as well as standard industry practice measures, will be fully committed to by the Applicant as integral aspects of Hornsea Four.

5.5.1.16 As and when new mitigation measures are agreed as commitments by Hornsea Four they will be added to the Commitments Register. The rankings set out within the Impacts Register will then be updated to take account of these new commitments. Hornsea Four will communicate the new commitments and any resulting changes to stakeholders in a timely manner. This communication will be done via the evidence plan process (section 5.6.5), PEIR and Local Information Events.

5.5.1.17 Even with a final project description and an unchanging environment, predictions of impacts and their effects on resources and receptors can by definition be uncertain. Predictions can be made using varying means ranging from qualitative assessment and expert judgement (including reference to the evidence base) through to quantitative techniques (e.g. modelling). The accuracy of predictions depends on the methods used and

the quality of the input data for Hornsea Four and the environment. Where an assumption has been made, the nature of any uncertainty which stems from it will be presented.

5.5.1.18 Where uncertainty affects the assessment of effects, a conservative (i.e. reasonable worst case) approach to assessing the likely residual effects will be adopted with mitigation measures developed accordingly.

5.5.1.19 To verify predictions and to address areas of uncertainty, monitoring will be proposed as a key aspect of environmental management for the construction and operation of Hornsea Four.

5.6 Consultation and the Evidence Plan Process

5.6.1 Overview

5.6.1.1 Before an application for a DCO is submitted to PINS, extensive informal and formal statutory consultation with key stakeholders (local authorities, statutory bodies, the local community and interest groups) is required. This consultation is undertaken during the preparation of consultation material (including the PEIR), before the DCO application is made.

5.6.2 Pre-application Consultation

5.6.2.1 With regards to the pre-application consultation, in brief, the Planning Act 2008 requires the Applicant to:

- consult with the relevant local authorities on what should be contained within the Applicant's SoCC, which will describe how the Applicant proposes to consult the local community about the proposal;
- have regard to the local authorities response to that consultation in preparing the SoCC;
- publish the SoCC in a locally circulating newspaper, as required by secondary legislation, and carry out consultation in accordance with the SoCC (this Scoping Report will help to inform that consultation exercise);
- consult a range of statutory consultees as identified by PINS (this Scoping Report will help inform that consultation exercise);
- set a deadline of at least 28 days by which responses to consultation must be received;
- notify PINS of the proposed DCO application;
- publicise the proposed application in accordance with regulations in secondary legislation;
- have due regard to relevant responses to publicity and consultation within the DCO application; and
- prepare a Consultation Report and submit it to PINS with the DCO application and ES.

5.6.3 Statement of Community Consultation

5.6.3.1 Under Section 47 of the Planning Act (2008), the Applicant has a duty to prepare a SoCC which sets out how it plans to consult local communities on the proposed development and must conduct its consultation in line with this statement. The Applicant must consult on and agree the contents of the SoCC with each of the local authorities, in whose area the proposed development is situated (as prescribed in section 43(1)).

5.6.3.2 In the case of Hornsea Four, all land in or on which the onshore works will be situated come under the local authority jurisdiction of East Riding of Yorkshire Council (ERYC). ERYC was consulted on the contents of a draft SoCC in September 2018.

5.6.3.3 In addition to ERYC, a number of neighbouring local authorities were consulted on the contents of the SoCC. Specifically this included:

- Hull City Council;
- Scarborough Borough Council;
- Rydale District Council;
- North Yorkshire County Council;
- York City Council;
- Selby District Council;
- Doncaster Metropolitan Borough Council; and
- North Lincolnshire Council.

5.6.3.4 A copy can also be found on the Hornsea Four website (www.hornseaprojects.co.uk/hornsea-project-four/).

5.6.4 Consultation Process

5.6.4.1 PINS, having received this Scoping Report, will consult with the relevant authorities and prescribed statutory consultees to seek their comments on the scope of the proposed studies. Following consultation with statutory consultees on the scoping of the EIA, the SoS will provide a Scoping Opinion. In parallel with this process, the Applicant will also hold a number of public consultation events as set out in SoCC. At these Local Information Events, attendees will have the opportunity to complete a feedback form either on the day or online, and a consultation summary will be produced and made available online. Attendees will also be invited to review and comment on the Impacts Register and Commitments Register and to suggest additions.

5.6.4.2 The EIA Regulations require Preliminary Environmental Information (PEI) to be provided for public consultation by those seeking a DCO for NSIPs. The format of and level of detail required in the PEI is not defined in a prescriptive way by the EIA regulations. However, it must cover those areas being assessed by the ES, which will accompany the application for Development Consent. The PEIR will incorporate the findings of the surveys and initial assessments to date and will enable consultees to develop an informed view of the potential significant environmental effects of Hornsea Four. The Applicant will be seeking feedback on this from statutory consultees, local communities and interested parties.

5.6.4.3 The Applicant plans to further refine Hornsea Four, in terms of the detailed consent application to be submitted, based upon the consultation responses received from the PEI process. The final results of the EIA will be presented in an ES and a summary of all the consultation responses received will be presented in a final Consultation Report, both of which will accompany the DCO application

5.6.5 Evidence Plan Process

5.6.5.1 The Evidence Plan (EP) process for Hornsea Four commenced in September 2018 and will seek to agree the evidence required to be submitted to the Planning Inspectorate as part of the DCO Application.

5.6.5.2 The primary aim of the EP process is to seek agreement with key stakeholders on the data and information to be included in the ES that will be drafted to support the application to PINS for a DCO (pursuant to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017). The process will also be used to communicate Hornsea Four's approach to proportionate EIA and how it intends to deliver this in regards to the data included in the ES. The EP will also incorporate matters relevant to the Conservation of Habitats and Species Regulations 2017 (the "Habitats Regulations") and will also seek to ensure that sufficient information is provided to support the Habitat Regulations Assessment (HRA) that will also accompany the DCO application (and in accordance with PINS Advice Note 10).

5.6.5.3 The EP process also seeks to make discussions more structured and efficient, allowing key environmental and consenting issues to be identified between multiple interested parties.

5.6.5.4 The EP process is a voluntary informal process and the EP will form a record of the agreements and disagreements between the Applicant and the interested parties at the point of the application being made (and a record of the discussions leading up to that point). The EP will form the basis for many of the documents produced during the application process which will be consulted on formally as part of the DCO application. It is hoped that the Evidence Plan log which will be used to record agreements and disagreements between the Applicant and the interested parties will help inform Statements of Common Ground (SoCG) such as may be required by PINS, the Examining Authority.

5.6.5.5 The EP process will be overseen by a Steering Group who will be responsible for ensuring that progress is being made and that the process is being conducted efficiently and according to the project timescales. The Steering Group consists of the following organisations:

- the Applicant;
- PINS;
- Natural England;
- Marine Management Organisation (MMO); and
- East Riding of Yorkshire Council (ERYC)

5.6.5.6 The EP process commenced in August 2018 and will continue until the application submission. Meeting and workshops have been scheduled to coincide with strategic project milestones such as receipt of scoping responses, pre and post PEIR and pre-DCO application submission. This schedule ensures that sufficient data are available to enable meaningful and effective discussions to take place. It is anticipated that Interim meetings on specific topics, for example Offshore and Intertidal Ornithology, are likely to be required.

5.7 Technical, Spatial and Temporal Scopes

5.7.1 The Technical Scope

5.7.1.1 Chapters 6 and 7 set out the approaches to be adopted for each technical topic (the 'technical scope') that makes up the EIA. In some instances reference is made at the topic level to the spatial and temporal scopes and these will be refined further in the course of the EIA and reported in the ES. For each topic, impacts and effects are either scoped in or

out, justification for such decisions provided and for matters scoped in the proposed assessment approach and baseline data requirements are described. A summary table that sets out each of the aspects or matters that are requested to be scoped out of the EIA is included in **Chapter 9**.

5.7.2 The Spatial Scope

5.7.2.1 In general terms, the spatial, or geographical, scope of the assessment takes into account the following factors:

- the physical extent of the proposed works, as defined by the scheme design;
- the nature of the baseline environment and the manner in which the impacts are likely to be propagated; and
- the pattern of governmental administrative boundaries, which provide the planning and policy context for the project.

5.7.2.2 For example, any potential effects on buried archaeology would tend to be confined to those areas physically disturbed by the works, whilst the effects of noise or visual intrusion could potentially be experienced at some distance from the works.

5.7.2.3 Appropriate study areas will be considered for each environmental topic by the specialists undertaking that assessment, and in agreement with the relevant consultees.

5.7.3 The Temporal Scope

5.7.3.1 The temporal scope of the assessment generally refers to the time periods over which impacts may be experienced. This will be established for each discipline, where appropriate through discussion with the relevant statutory consultees. Terms used to qualify the duration of an impact or effects will tend to be specific to the topic being considered.

5.7.3.2 In overall terms the EIA will assess effects during the construction, operation and maintenance, and, where appropriate, decommissioning phases of Hornsea Four.

5.8 Applying the 'Rochdale Envelope' Approach

5.8.1.1 Flexibility to respond to emerging economic circumstances and technological advances is essential if Hornsea Four is to proceed and be successful. A degree of flexibility will, therefore, be built into the Hornsea Four design basis for the DCO application by applying a Rochdale Envelope approach that is consistent with PINS Advice Note Nine (PINS, 2012).

5.8.1.2 This approach does introduce some complexity into the EIA process common to many large scale developments, which are dependent on market conditions for their delivery. The 2017 Regulations require an ES to provide a description of the location, design and size of the scheme to enable the likely significant environmental effects to be assessed and to enable the decision-maker, statutory consultees and the public to make properly informed responses.

5.8.1.3 A balance has to be sought between defining the proposals in enough detail to predict their impacts, while leaving enough flexibility to enable Hornsea Four to be successfully delivered under conditions which may be subject to change. The design parameters will provide an 'envelope' for assessing the impacts of Hornsea Four. It is intended that, in order

to ensure that likely significant effects of Hornsea Four on the environment are described and assessed, parameters will be set which are broad enough to encompass the potential variations in design and other aspects of Hornsea Four. The EIA will take account of all the reasonable variations in the form of Hornsea Four that would be permissible under the parameters, and describe and assess the likely significant effects on the environment as appropriate. In doing so the EIA will assess those parameters likely to result in the maximum adverse effect (the worst case scenario) and determine significance of effects accordingly.

5.8.1.4 Such an approach is good practice, as reflected in case law on the 'Rochdale Envelope' principle. Suitably applied in EIA it can help to avoid the need for protracted re-submission procedures at a later stage, whilst giving a comprehensive assessment of the likely environmental effects.

5.9 Inter-Relationships

5.9.1.1 The inter-related effects assessment considers the likely significant effects of multiple impacts from the proposed development on one receptor. For example, noise and air quality together could have a greater effect on a residential receptor than each impact considered separately.

5.9.1.2 Inter-related effects are assessed through consideration of all effects on a receptor by the Project. An assessment of the potential for all effects on that receptor to interact, whether that be spatially or temporally, results in the identification of inter-related effects on a receptor (e.g. all effects on human amenity, such as noise and air quality, access, and traffic; these might be short-term, temporary or transient effects or incorporate longer term effects).

5.9.1.3 The inter-related effects assessment approach will proceed through the following key steps:

- identification of relevant receptors from the assessment of significance of effect sections within each topic chapter;
- identification of the impact source pathways that can affect the receptor and identification of the ES chapter where those pathways are described and assessed;
- identification of potential effects on these receptor groups through a review of assessment sections; and
- production of the inter-related effects assessment, utilising tables listing all potential effects on selected receptors during the construction, O&M and decommissioning phases.

5.9.1.4 It is important to note that the inter-related effects assessment will consider only effects produced by the Hornsea Four development, and not those from other projects (these will be considered within the cumulative effects assessment (CEA)).

5.10 Cumulative and Indirect Effects

5.10.1.1 Projects, plans and proposals with which Hornsea Four may have cumulative effects have been provisionally identified and screened during EIA scoping. Cumulative effects are defined as those effects on a receptor that may arise when the development is considered together with other existing and/ or approved projects. The Cumulative Effects Assessment

(CEA) undertaken up to this point, together with details of the CEA assessment methodology and the proposed way forward, is set out in **Chapter 8**.

5.10.1.2 There is no widely accepted definition of 'indirect' effects and the term is often used interchangeably with 'secondary' effects. However the 2017 EIA Regulations do distinguish between the two terms; i.e. they mean different things. For the purposes of this EIA 'secondary' (and higher order) effects are taken to be part of a chain of impacts or effects that can be readily traced back to an action of Hornsea Four. Indirect effects may be partly the consequence of an action of Hornsea Four but occur much later in time or are much farther removed in distance, albeit still reasonably foreseeable. Indirect effects may include the consequences of economic or population growth induced by a project and other effects related to induced changes in the pattern of land use, population growth rate, and related effects on air, water and soil and ecosystems in general. In the context of Hornsea Four 'indirect effects' falling within this definition are likely to be scoped out since the project will not lead to long-term changes in population or the pattern of land use and the consequent effects of these.

5.11 Transboundary Effects

5.11.1 Legislation and Guidance

5.11.1.1 Transboundary effects arise when impacts from the development within one European Economic Area (EEA) state affects the environment of another EEA state(s). The need to consider such transboundary effects has been embodied by the United Nations Economic Commission for Europe Convention on EIA in a Transboundary Context (commonly referred to as the 'Espoo Convention'). The Convention requires that assessments are extended across borders between Parties of the Convention when a planned activity may cause significant adverse transboundary effects.

5.11.1.2 The Espoo Convention has been implemented in the UK for the purposes of NSIPs by the Infrastructure Planning (EIA) Regulations 2017. Regulation 32 sets out a prescribed process of consultation and notification. In addition, PINS Advice Note Twelve: Transboundary Impacts and Processes (PINS, 2018) sets out the procedures for a consultation in association with an application for a DCO where such a development may have significant transboundary effects.

5.11.1.3 PINS Advice Note Twelve explains this procedure involves the following broad steps which are split into two stages:

5.11.1.4 Stage 1 (Pre-application):

- Applicant carries out consultation with EEA State(s) (as necessary);
- Applicant notifies PINS of EIA potentially requiring transboundary assessment;
- Applicant prepares initial matrix to identify potential significant effects on other EEA State(s);
- PINS undertakes transboundary screening for potential significant effects;
- PINS notifies other relevant EEA State(s), including London Gazette notice; and
- EEA State(s) notify PINS of wish to participate in consultation.

5.11.1.5 Stage 2 (Submission/Post-Submission):

- Applicant submits application, including translated Non-Technical Summary (NTS);

- PINS undertakes consultation with other relevant EEA State(s);
- EEA State(s) consult with their public and provide comments to PINS; and
- EEA State(s) Consultation responses are taken account of by PINS in decision making process.

5.11.1.6 Hornsea Four will follow this broad process with regard to transboundary EIA, including any other guidance that may prevail at the time of undertaking the assessment.

5.11.2 Screening

5.11.2.1 Identification and screening of transboundary effects has been undertaken and is presented in **Appendix K**.

5.12 Other EIA Matters

5.12.1 Human Health

5.12.1.1 Under the 2017 Regulations (Regulation 5(2) and paragraph 4 of Schedule 4) the EIA must identify, describe and assess, the direct and indirect significant effects of a proposed development (including any operational effects if appropriate) on a number of factors which now includes human health.

5.12.1.2 Following best practice, health impacts assessment typically take the World Health Organization's (WHO) definition, which states that health is:

5.12.1.3 "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (World Health Organization, (1948), Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946).

5.12.1.4 In this context the main determinants of human health are made up of:

- environment (noise, air quality, visual);
- employment and income;
- education;
- housing;
- lifestyle;
- physical activity;
- access to services, amenities and social networks;
- community severance or cohesion;
- transport;
- social networks and connectivity;
- community identity; and
- access and accessibility.

5.12.1.5 Hornsea Four is predominantly an offshore construction and operation activity with onshore construction works to install buried cables and a substation leaving an operating substation as the only long-term aspect of the project onshore. As such the main areas in which it will physically interact with human health determinants is in regard to environment (noise, air quality, visual) and transport. Exposure to electro-magnetic radiation is also a consideration for human health. However, all aspects of Hornsea Four will be designed in accordance with strict industry codes that make provision for the

protection of human health from electro-magnetic radiation. Hornsea Four will also provide opportunities for employment and economic benefits.

5.12.1.6 Human health will be addressed in the PEIR and the ES in the context of environment (noise, air quality, visual), traffic and transport and socio-economic effects. Each technical topic chapter will clearly set out the implications of Hornsea Four for human health and where necessary cumulative effects will also be examined. A stand-alone chapter for the effects on human health is not proposed.

5.12.2 Major Accidents and / or Disasters

5.12.2.1 Regulation 5 (4) of the 2017 Regulations requires the EIA to consider:

"expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to that development."

5.12.2.2 2017 Regulations go on to say in Paragraph 8 of Schedule 4 the ES should include:

"A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or UK environmental assessments may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies."

5.12.2.3 The Hornsea Four project will not include any large inventories of hazardous material that could be released in the event of a natural disaster affecting the project.

5.12.2.4 The main areas of vulnerability for the development stem from its marine operating conditions (but for which it will be designed in the first place), coastal erosion at the landfall and flood risk (lowest level) at the substation. However the likelihood of a natural disaster for any these components leading to consequential significant environmental effects is negligible.

5.12.2.5 However relevant aspects of the EIA will examine risks to Hornsea Four and potential consequential risks to the environment and people within the relevant technical topics (e.g. flood risk). A standalone chapter on the topic of major accidents and/or disasters is not proposed in the PEIR.

5.13 Environmental Management

5.13.1.1 In addition to the specific mitigation measures identified for each of the environmental topics, Hornsea Four will conform to general environmental management practices. Under the Construction (Design and Management) Regulations 2015, Hornsea Four's CEMP or CoCP will include general environmental and health and safety considerations.

5.13.1.2 It is no longer a formal requirement for developers to produce a Site Waste Management Plan. Nevertheless, it is recognised that construction, operation and demolition stages all

have the potential to create waste. The applicant will adopt good construction and management practices to ensure waste is minimised as far as possible and that the storage, transport and eventual disposal of waste have no significant environmental effects. Management and collection of the waste streams will be carried out under the requirements of the UK waste regulatory regime. The PEIR project description will set out the waste management measures that Hornsea Four will adopt during construction, operation and decommissioning (in principle only for the latter) to avoid any significant adverse effects on the environment or people from the handling and disposal of waste.

6 Environmental Topics and Potential Effects Offshore

6.1 Marine Geology, Oceanography and Physical Processes

6.1.1 Introduction

6.1.1.1 This section of the Scoping Report presents the marine geology, oceanography and physical processes topic (hereafter collectively referred to as 'physical processes') of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components (i.e. seaward of MHWS) of Hornsea Four on these receptors. In most cases, changes in physical processes are generally considered as 'sources' of a change and 'pathways' for effects which have the potential to influence other environmental 'receptors'. The Hornsea Four physical processes assessment will be used to inform other EIA topic assessments, including:

- Benthic and Intertidal Ecology;
- Fish and Shellfish Ecology;
- Marine Mammal Ecology;
- Offshore Ornithology;
- Commercial Fisheries; and
- Shipping and Navigation.

6.1.1.2 In some cases, a physical process feature can also be considered directly as a receptor, such as the adjacent shoreline or a designated habitat feature such as a subtidal sandbank, or a water body feature with a biological interest such as the Flamborough Front.

6.1.2 Study Area

6.1.2.1 The physical processes study area for Hornsea Four is defined as:

- the Hornsea Four array area within which the foundations for WTGs and offshore platforms and inter-array cables will be located;
- the Hornsea Four offshore export cable corridor (offshore ECC) from the Hornsea Four array area up to the landfall;
- the landfall up to MHWS;
- locations within the area for lease and along the export cable corridor where there is a requirement to dispose of construction related spoil, where disturbed sediments may be transported and settle on the seabed and where wave and tidal wake effects may propagate away from foundations and the extents of any of these effects; and
- adjacent projects which may also interact with the effects of Hornsea Four, leading to a potential cumulative effect.

6.1.3 Baseline Environment

6.1.3.1 The environmental baseline for physical processes relates to the distribution of sediments and bathymetry features on the seabed across the study area and the water body which moves across the seabed and may also act on the sediments to mobilise and transport the material.

6.1.3.2 The component parts of the physical process baseline include:

- seabed geology and surficial sediments;

- seabed profile (general bathymetry plus bedform features, such as sandwaves as indicators of bedload transport);
- tidal and non-tidal influences (water levels, currents and surges);
- waves; and
- suspended sediments.

6.1.3.3 In addition, water temperature is also included as a baseline parameter of the water body to help establish the interface between stratified and well-mixed water bodies which define the location of thermal fronts such as the Flamborough Front.

6.1.3.4 An initial desk-based review of literature and data sources supports this Scoping Report. Table 6-1 summarises key physical processes data sources which provide coverage of the Hornsea Four array area and the offshore ECC.

Table 6-1 – Key sources of Physical Processes Data

Source	Summary	Coverage of Hornsea Four array area and ECC
Zonal characterisation (ZoC) including metocean, geophysical and benthic surveys (SMart Wind, 2012)	Initial broad-scale evaluation of the former Hornsea zone to help establish areas for development. This work was supported by extensive baseline metocean, geophysical and benthic surveys	Includes coverage of Hornsea Four array area and adjacent projects (Hornsea Project One, Hornsea Project Two and Hornsea Project Three)
Existing wave and tidal models (SMart Wind, 2015a)(SMart Wind, 2015a)(SMart Wind, 2015a), (SMart Wind, 2015b)(SMart Wind, 2015b)(SMart Wind, 2015b) and (Ørsted, 2018)(Ørsted, 2018)(Ørsted, 2018)	Wave and tidal models previously calibrated against ZoC metocean survey data provide existing outputs offering an expanded view of baseline conditions as well as a quanitifed assessment of potential impacts. Existing model outputs will serve as a means of supporting simplified approaches for Hornsea Four. No additional modelling is proposed	Includes coverage of full study area up to the coastline
Atlas of UK Marine Renewable Energy (DECC, 2008)	Synoptic description of waves, tidal levels and currents to complement baseline information from existing models	Includes coverage of full study area up to the coastline
The European Marine Observation and Data Network (EMODnet) for thematic mapping of bathymetry, seabed substrate and geology	Baseline mapping of bathymetry, seabed substrate and sub-surface geology to provide an overview of seabed conditions, complementing site specific surveys	Includes coverage of full study area up to the coastline
GeoIndex	Database of analysed surficial sediment samples providing quantification of sand, gravels and mud content, directly complements EmodNet seabed substrates	Includes coverage of full study area up to the coastline
Southern North Sea Sediment Transport Study (HR Wallingford, CEFAS/UEA, Posford Haskoning, and Brian D'Olier, 2002)	An in-depth review of the sediment transport regime across the Southern North Sea	Includes coverage of full study area up to the coastline
UK Offshore Energy Strategic Environmental Assessment. Phase 3 (OESEA3) (DECC, 2016)	A regional sea description with summaries of geology, processes and sedimentology	Includes coverage of full study area up to the coastline
Sand banks, sand transport and offshore wind farms (Kenyon & Cooper, 2005)	Complements the Southern North Sediment Transport Study, offering a UK-wide and regional perspective of sediment pathways. Highlights	Includes coverage of full study area up to the coastline

Source	Summary	Coverage of Hornsea Four array area and ECC
	relevance of sand transport issues to offshore wind farms	
Suspended sediment mapping (CEFAS, 2016)	Synoptic description of baseline seasonal (monthly) variation in suspended paeticulate matter across the study area derived from long-term satellite observations	Includes coverage of full study area up to the coastline
Temperature modelling and mapping of frontal development from (Connor, et al., 2006), (van Leeuwen, Tett, Mills, & van der Molen, 2015) and Copernicus Marine Environmental Monitoring Service	Complementary data types offering a description of the Flamborough Front and mechanisms for seasonal development and decay	Includes coverage of full study area up to the coastline
Flamborough Head to Gibraltar Point Shoreline Management Plan (Scott Wilson, 2010)	Provides coastal process understanding of shoreline behaviour	Landfall, shoreline and immediate sub-tidal
Nearshore seabed survey: Flamborough Head to Spurn Point (Channel Coastal Observatory, 2014)	Detailed mapping of landfall area	Landfall, shoreline and immediate sub-tidal

Overview of Physical Processes Baseline Environment

Seabed

Array area

6.1.3.5 The Hornsea Four array area is approximately 65 km due east of Flamborough Head, at its closest point and adjacent to Hornsea Project Two on the eastern boundary (**Figure 6-1**). Various marine designated areas (Marine Conservation Zones (MCZs) shown in purple and Special Areas of Conservation (SACs) shown in blue surround Hornsea Four. Dogger Bank SAC, North Norfolk Sandbanks and Saturn Reef SAC, and Inner Dowsing, Race Bank and North Ridge SAC all include Annex I habitat features described as protected sandbanks which are slightly covered by seawater all of the time. The North Norfolk Sandbanks and Saturn Reef SAC is the closest SAC, around 15.2 km to the south-east.

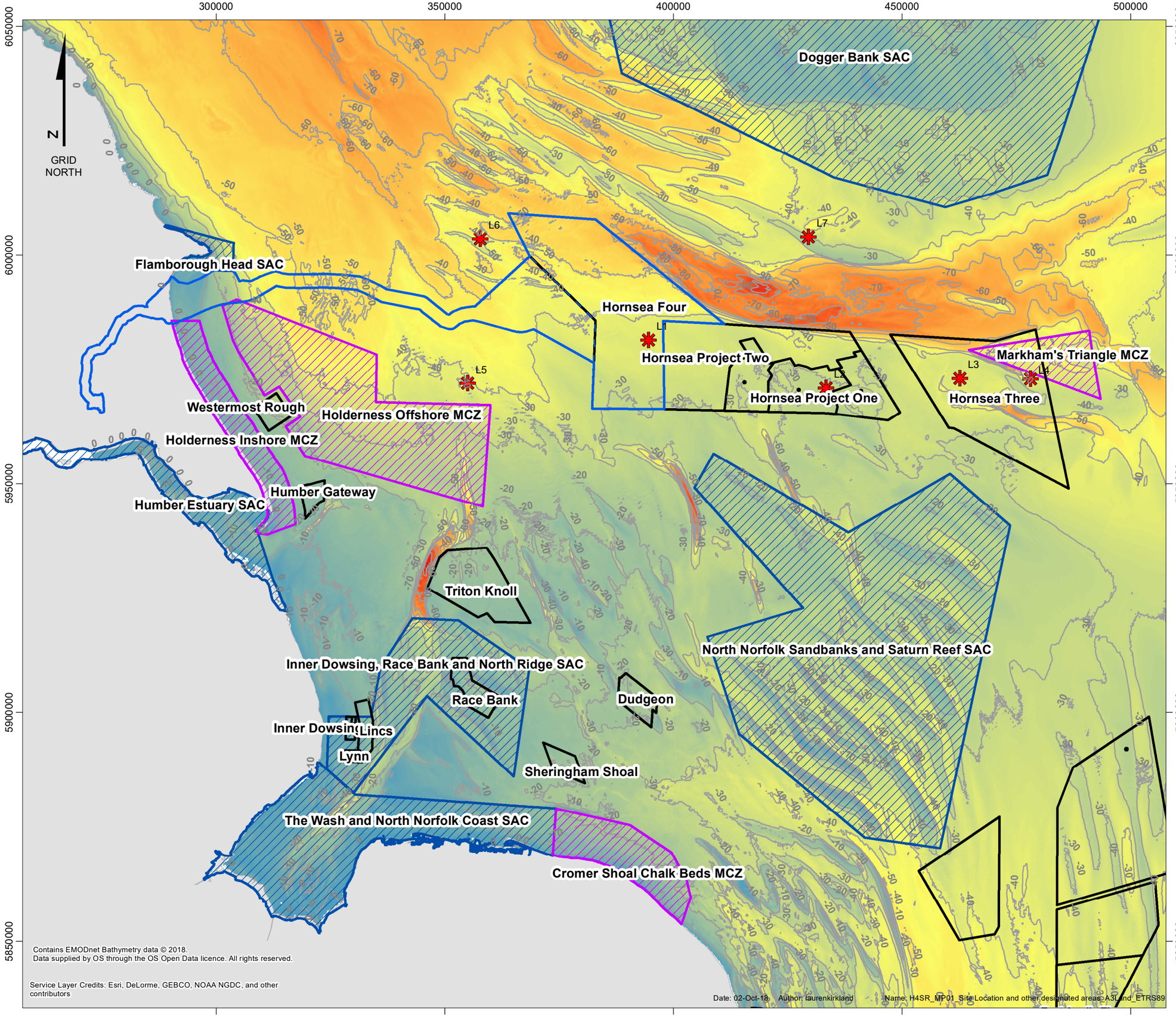
6.1.3.6 Water depths generally vary from around 30 m below Chart Datum (CD) in the south of the Hornsea Four array area to more than 50 m below CD in the north, although the greatest depths are on the north-eastern flank which shelves into Outer Silver Pit. Sandwaves are present within the Hornsea Four array area, particularly across the north-western corner and also along the southern margin (**Figure 6-1**). The general alignment of these sandwaves is consistent, with a flow transverse crest aligned perpendicular to the north-west which provides an indicator of net migration of sand pathways for the area.

6.1.3.7 Surficial sediments across the Hornsea Four array area are typically sandy material with small amounts of gravel and muds. The main exception is along the southern boundary where there is a slightly higher percentage of gravels and a coarser substrate described as slightly gravelly sand (**Figure 6-2**).

6.1.3.8 The surficial sediments are interpreted as being a Quaternary glacial till of the Bolders Bank Formation. The ZoC geophysical survey suggests this sediment deposit is around 10 m deep (SMart Wind, 2012).

Hornsea Four

Location Of Hornsea Four In Relation To Other Designated Areas And Wind Farms Figure 6.1



Scoping Boundary

Array Area

Other Offshore Windfarm

Special Protection Area

Marine Conservation Zone

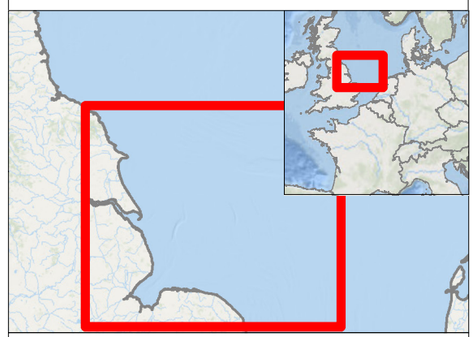
10m Contours

Depth (m) below Lowest Astronomic Tide

+7

-97

Metocean Buoy Locations



Coordinate system: ETRS 1989 UTM Zone 31N

Vertical reference: Chart Datum (CD)

Scale@A3: 1:800000

0 5 10 20 30 40 Kilometres

0 3 6 12 18 Nautical Miles

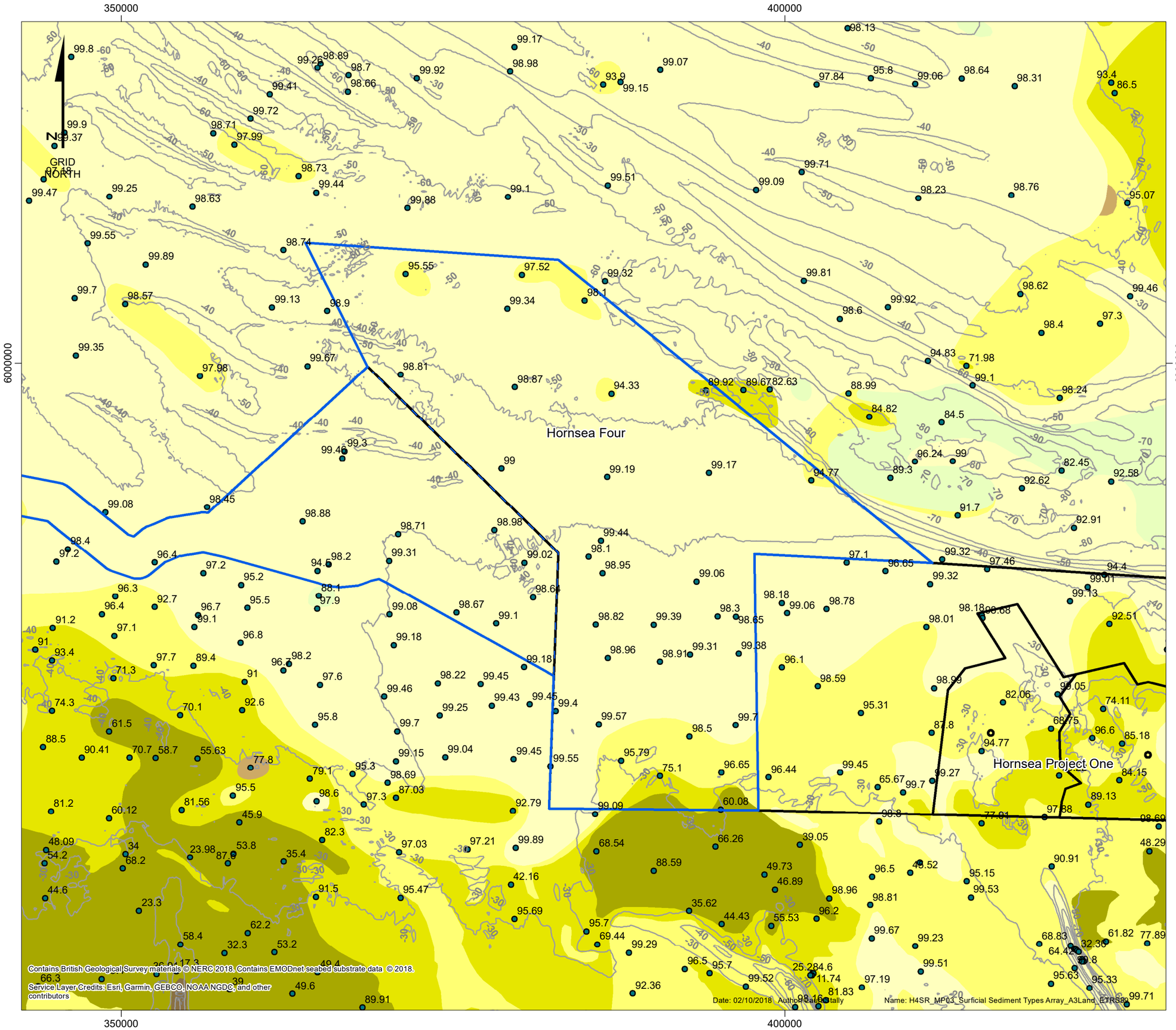
Contains EMODnet Bathymetry data © 2018.
Data supplied by OS through the OS Open Data licence. All rights reserved.

Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Date: 02-Oct-18 Author: laurenkirkland Name: H4SR_MP01_Site Location and other designated areas_A3Land_ETRS89

Location Of Hornsea Four In Relation To Other Designated Areas And Wind Farms
Document no: H4SR_MP01
Created by: NC
Checked by: CC
Approved by: LK

GoBe Ørsted

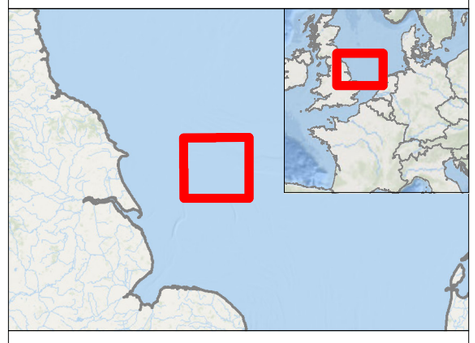


Hornsea Four
Surficial Sediment Types Across Array Area
Figure 6.2

- Scoping Boundary
- Array Area
- Other Offshore Windfarm
- Sediment Sand Fraction
- 10m Contours

Seabed Substrate

- muddy Sand
- Sand
- (gravelly) Sand
- gravelly Sand
- sandy Gravel
- gravelly muddy Sand
- muddy sandy Gravel



Coordinate system: ETRS 1989 UTM Zone 31N
Vertical reference: Chart Datum
Scale@A3: 1:276000

0 1 2 4 6 8 10 12 Kilometres
0 1 2 4 6 Nautical Miles

Surficial Sediment Types
Across Array Area
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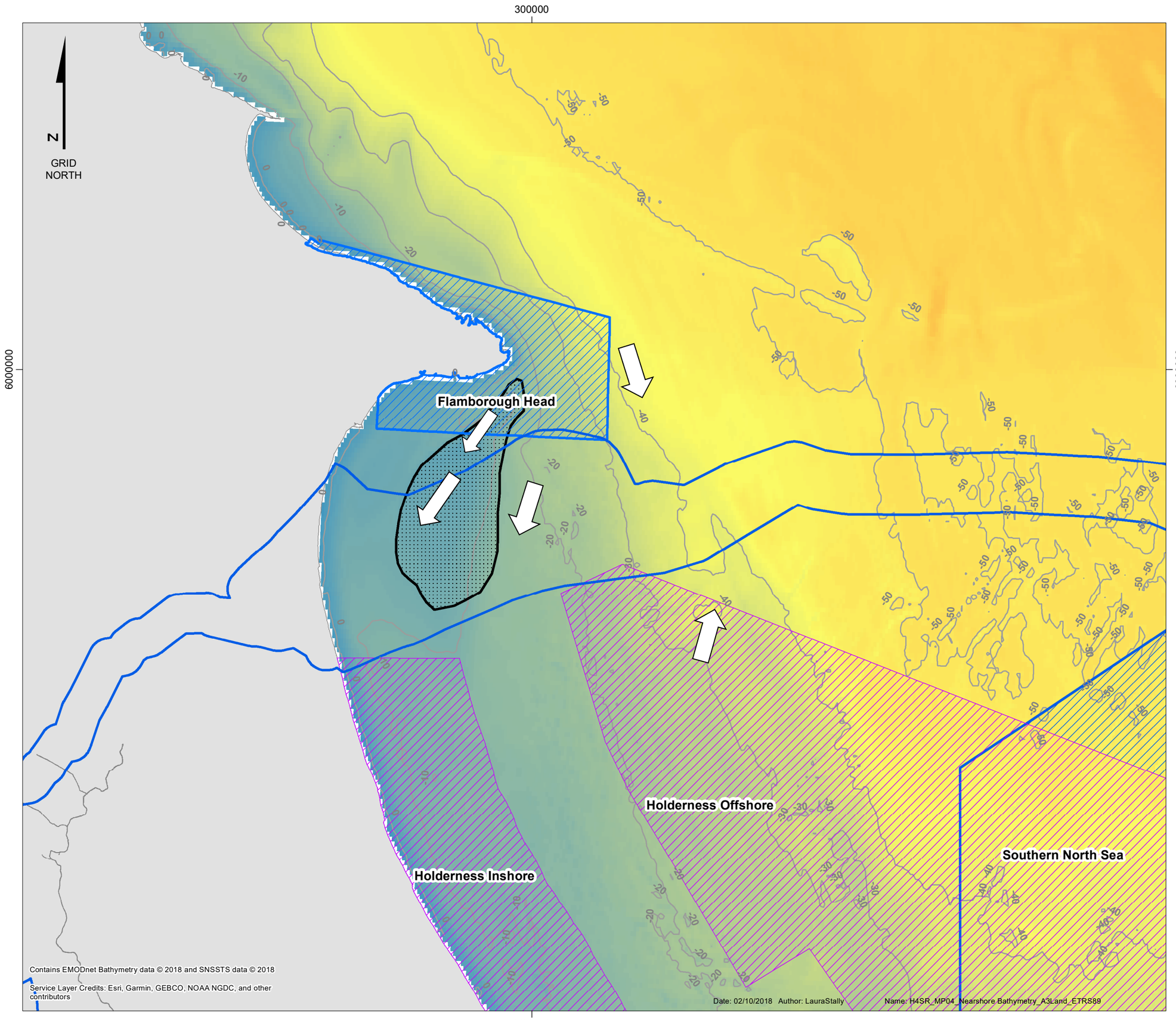
Offshore ECC

6.1.3.10 Depths across the offshore ECC are relatively similar to the Hornsea Four array area until closer to the coastline. In the lee of Flamborough Head there is a shallow bank known as Smithic Sands (**Figure 6-3**), a headland associated banner type bank (HR Wallingford, CEFAS/UEA, Posford Haskoning, and Brian D'Olier, 2002). This sandbank is listed by the Joint Nature Conservation Committee (JNCC) as a potential sandbank area for Annex I habitat, although the site is not presently designated.

6.1.3.11 Sediments across the offshore ECC show an increasing gravel content towards the coast, transiting from the sandy Hornsea Four array area into slightly gravelly sand, gravelly sand to sandy gravel (**Figure 6-4**). The beach itself is a thin veneer of sand over rock.

Hornsea Four
Nearshore Bathymetry
Figure 6.3



Scoping Boundary

Special Area of Conservation

Marine Conservation Zone

Smithic Bank

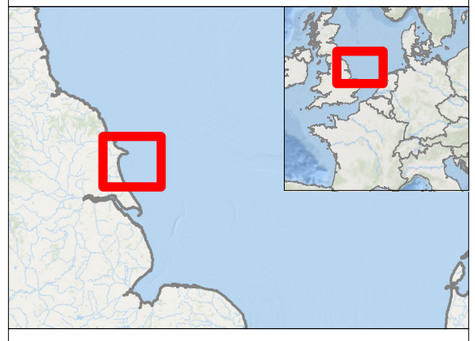
10m Contours

Depth (m) below Lowest Astronomic Tide

+7

-97

Sand Transport Pathways (SNSSTS, 2002. Southern North Sea Sediment Transport Study, Phase 2)



Coordinate system: ETRS 1989 UTM Zone 31N

Vertical reference: Chart Datum

Scale@A3: 1:182000

0 1 2 4 6 8 Kilometres

0 0.5 1 2 3 4 5 Nautical Miles

Near Shore Bathymetry
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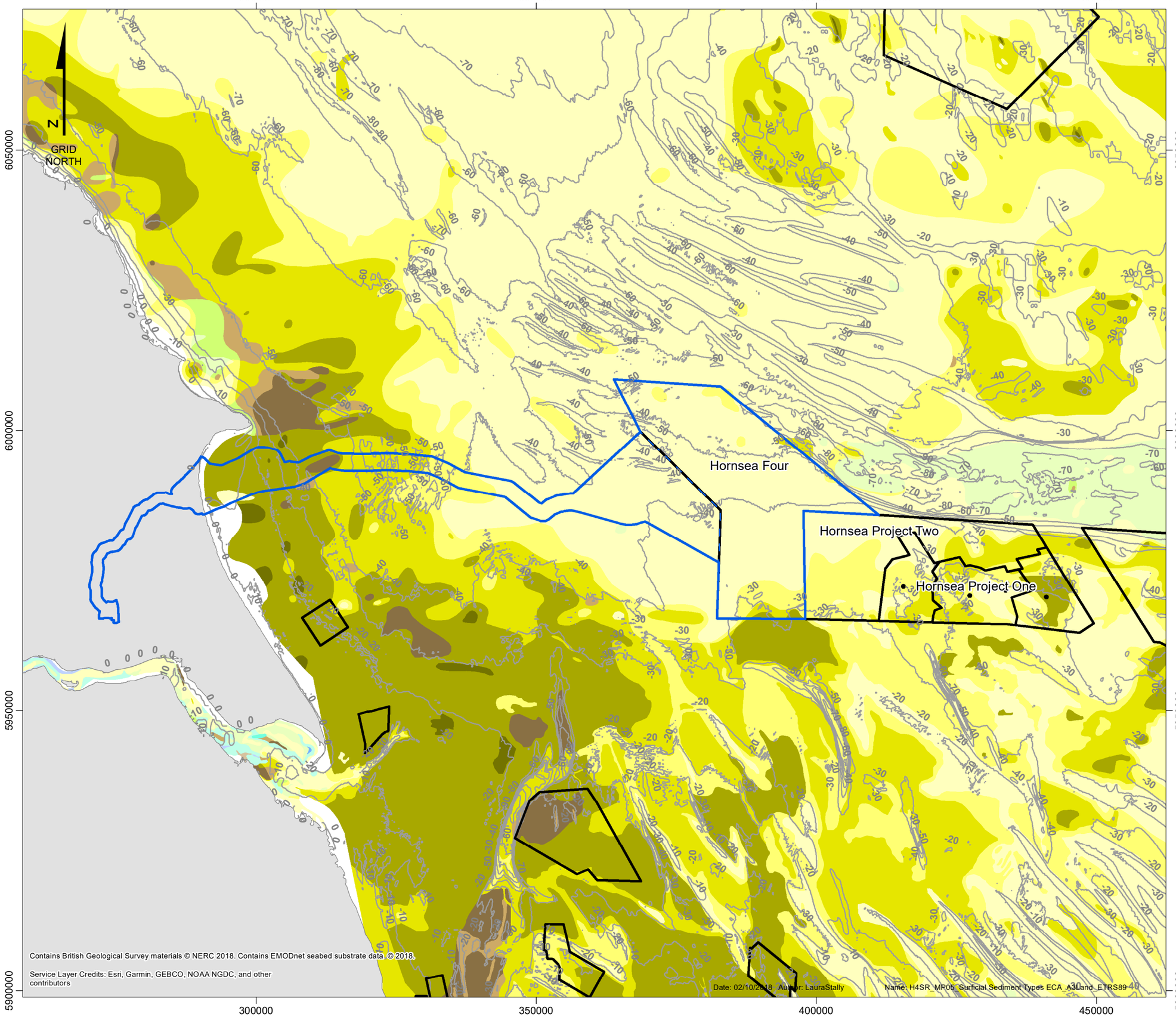
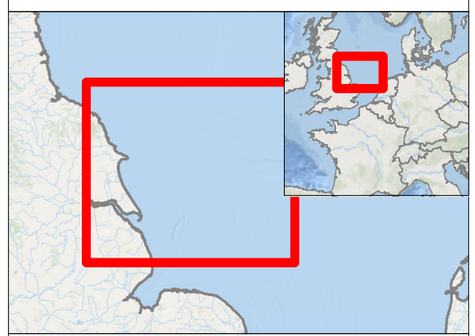
Hornsea Four
Surficial Sediment Types Across Export Cable Corridor Area
Figure 6.4



- Scoping Boundary
- Array Area
- Other Offshore Windfarm
- 10m Contours

Seabed Substrate

- Mud
- (gravelly) Mud
- sandy Mud
- (gravelly) sandy Mud
- muddy Sand
- (gravelly) muddy Sand
- Sand
- (gravelly) Sand
- gravelly Sand
- sandy Gravel
- Gravel
- gravelly Mud
- muddy Gravel
- gravelly muddy Sand
- muddy sandy Gravel



Coordinate system: ETRS 1989 UTM Zone 31N
Vertical reference: Chart Datum
Scale@A3: 1:653000

0 4 8 16 24 32 Kilometres
0 3 6 12 18 Nautical Miles

Surficial Sediment Types
Across Export Cable Corridor Area
Document no: H4SR_MP05
Created by: NC
Checked by: CC
Approved by: LK

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Water column

Array Area

6.1.3.12 The baseline for the water column is characterised by the ZoC metocean survey. Of specific interest to Hornsea Four is information from Site L1 which collected around one year of water level, currents, waves, suspended sediment and temperature information (**Figure 6-1**). The spread of six other measurement locations in the metocean survey provides a basis for describing spatial variance in conditions both east and west of Site L1.

6.1.3.13 The Hornsea Four array area experiences a tidal exchange of water with a flood tide that flows in a general south-easterly direction down the North Sea and an ebb tide that drains away to the north-west. Maximum observed flows at Site L1 from the survey reached 1.02 m/s, but more generally the mean spring maximum rate is around 0.61 m/s and the corresponding mean neap rate 0.29 m/s (SMart Wind, 2012).

6.1.3.14 The observed mean spring tidal range determined from Site L1 is 3.28 m, with a corresponding mean neap range of 1.84 m (SMart Wind, 2012).

6.1.3.15 Wave observations from Site L1 suggest the most frequent wave direction is from the north-west, with the largest wave heights also occurring from this direction. Seasonal variation indicated that typical summer wave heights were around 1.53 m increasing to an average winter wave height of 2.29 m. The maximum observed wave height (Hs) during the survey was 4.48 m.

6.1.3.16 Regional scale interpretations of bedload sediment transport suggest a north-westerly (net) transport pathway for the offshore area which is seaward of a bedload parting zone (Kenyon & Cooper, 2005) (**Figure 6-5**). This transport direction appears to be supported by the alignment of sandwaves across the Hornsea Four array area. The pathway is driven by tidal action since water depths are beyond the reach of wave stirring effects. These sand transport pathways suggest the Hornsea Four array area is updrift of the North Norfolk Sandbanks and Saturn Reef SAC, although flood tide transport would still be to the south-east.

6.1.3.17 Turbidity (represented by suspended particulate matter, SPM) is relatively low across the Hornsea Four array area with surface concentrations typically less than 5 mg/l across the whole year (CEFAS, 2016). This is due to both a low content of fine material in the seabed sediments and the area being distant from any terrestrial sources, such as the Humber Estuary and the Holderness cliffs. **Figure 6-6** provides a synoptic view of long-term SPM concentrations averaged for the month of December and deduced from satellite data for the period 1998 to 2015.

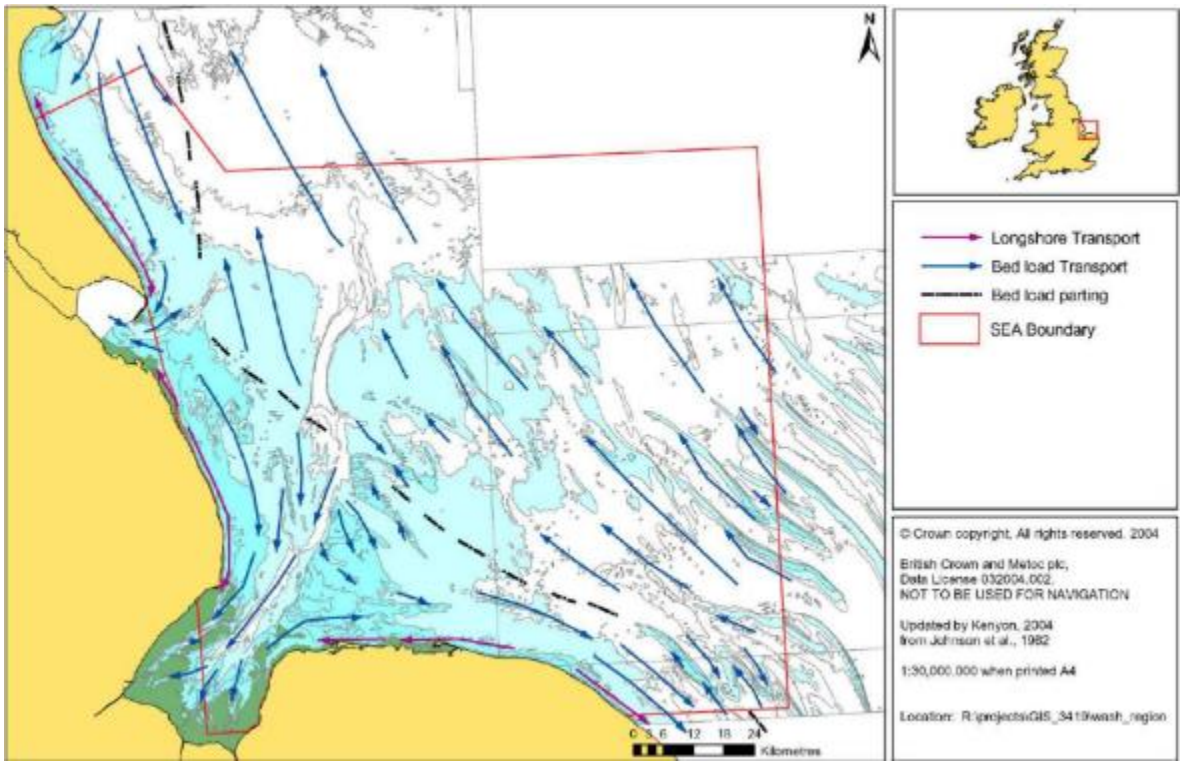


Figure 6-5 - Bedload sediment transport pathways (Kenyon & Cooper, 2005)

Hornsea Four
Average Suspended Particulate Matter For December
Figure 6.6

250000 300000 350000 400000

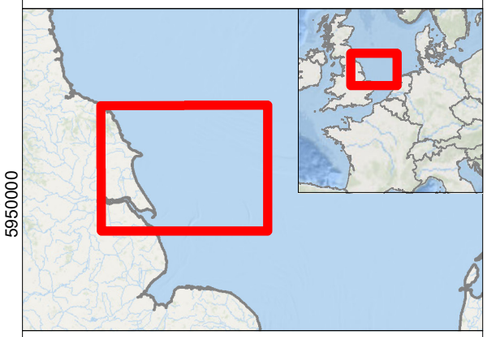
6050000 6000000 5950000

N
GRID NORTH

Hornsea Four
Hornsea Project Two
Hornsea Project One

Scoping Boundary
Array Area
Other Offshore Windfarm
10m Contours

Mean December Suspended Sediment Matter (mg/l)
High : 50
Low : 0



Coordinate system: ETRS 1989 UTM Zone 31N
Vertical reference: Chart Datum
Scale@A3: 1:653000

0 4 8 16 24 32 Kilometres
0 3 6 12 18 Nautical Miles

Contains British Geological Survey materials © NERC 2018. Contains EMODnet seabed substrate data © 2018.

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Date: 02/10/2018 Author: LauraStally Name: H4SR_MP08_Average SPM For December2 ECA_A3Land_ETRS89

Average Suspended Particulate Matter For December
Document no: H4SR_MP08
Created by: NC
Checked by: CC
Approved by: LK

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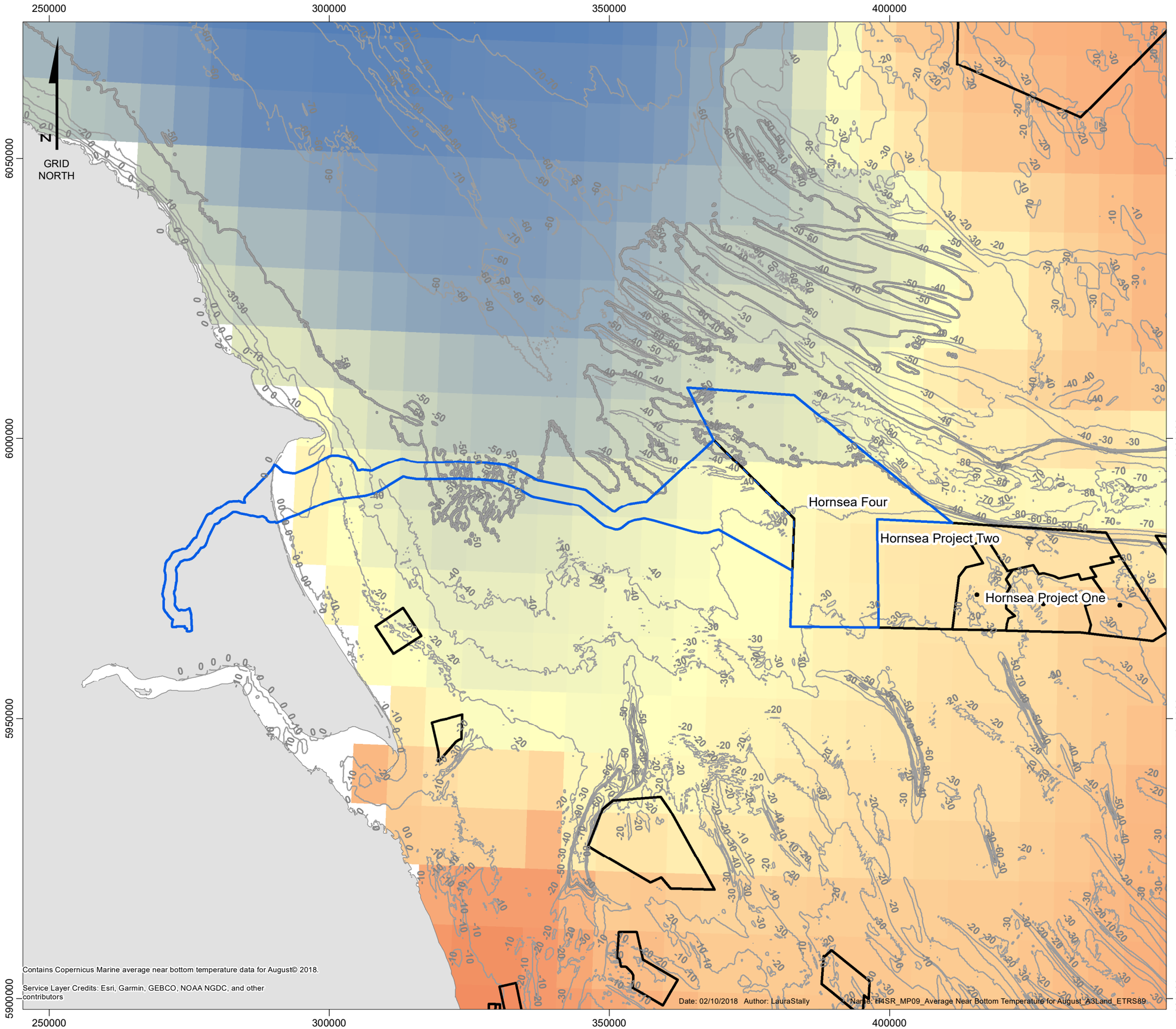
6.1.3.18 The southern North Sea is typically described as a well-mixed water body. Near-bed water temperatures recorded at Site L1 are generally around 9.5°C. Well-mixed conditions are mainly due to shallower depths and the ability of winds and tides to stir water sufficiently without the onset of any stratification (DECC, 2016). In comparison, the northern North Sea is relatively deeper with slightly weaker currents, this helps temperature stratification develop from the spring into the summer months. The transition between these two water bodies develops from about 10 km offshore of Flamborough Head in the form of a front which generally follows the alignment of the 50 m isobath as a bottom feature (Hill, et al., 1993). **Figure 6-7** presents average monthly near bottom seawater temperature values from Copernicus Marine Environmental Monitoring Service.

Hornsea Four
Average Near Bottom Temperature For August
Figure 6.7



Scoping Boundary

Array Area

Other Offshore Windfarm

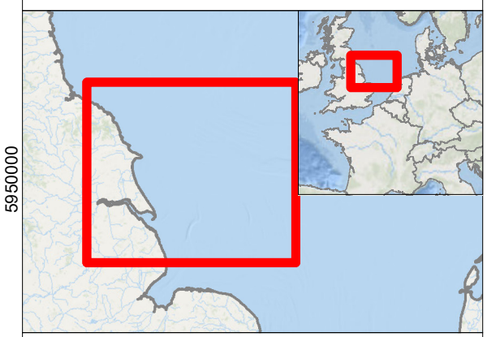
10m Contours

-50 Isobath

Seabed Temperature (°C)

High : 293

Low : 283



Coordinate system: ETRS 1989 UTM Zone 31N

Vertical reference: Chart Datum

Scale@A3: 1:653000

0 4 8 16 24 32 Kilometres

0 3 6 12 18 Nautical Miles

Average Near Bottom Temperature For August
Document no: H4SR_MP09
Created by: NC
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Offshore ECC

6.1.3.20 Tidal range increases from east (adjoining the Hornsea Four array area) to west along the offshore ECC, reaching 5.0 m for mean spring tides and 2.4 m for mean neap at Bridlington (**Figure 6-8**). This increase in range from the array area is due to the greater distance from a North Sea amphidrome (a location of minimal tidal amplitude offshore of Denmark).

Hornsea Four
Mean Spring Tidal Range
Figure 6.8

250000 300000 350000 400000 450000

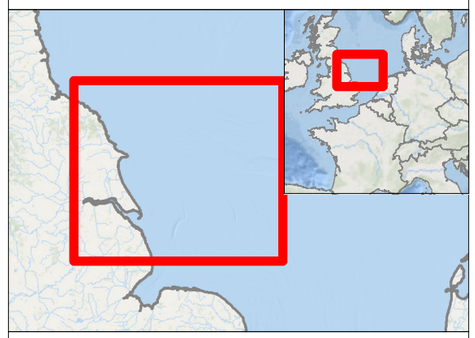
6050000 6000000 5950000 5900000

N
GRID NORTH

Hornsea Four
Hornsea Project Two
Hornsea Project One

Scoping Boundary
Array Area
Other Offshore Windfarm
10m Contours

Mean Spring Tidal Range (m)
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
5.0 - 6.0



Coordinate system: ETRS 1989 UTM Zone 31N
Vertical reference: Chart Datum
Scale@A3: 1:653000

0 4 8 16 24 32 Kilometres
0 3 6 12 18 Nautical Miles

Contains Atlas of UK Marine Renewable Energy data DECC © 2008.

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Date: 02/10/2018 Author: LauraStally Name: H4SR_MP10_Mean Spring Tidal Range_A3Land_ETRS89

Mean Spring Tidal Range
Document no: H4SR_MP10
Created by: NC
Checked by: CC
Approved by: LK

GoBe
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6.1.3.21 From the Hornsea Four array area to the landfall, tidal flows become steadily influenced by the alignment of the coast and the shallowing profile of the seabed. In particular, Flamborough Head creates locally faster flows but also more sheltered conditions within the lee of Bridlington Bay.

6.1.3.22 Wave activity generally weakens towards the coast relative to the Hornsea Four array area due to shoaling (DECC, 2008). Flamborough Head creates local sheltering with offshore wave energy from the north and north-westerly sectors having to diffract and refract around the headland which then changes the orientation of these waves.

6.1.3.23 Suspended sediment levels increase marginally towards the coast with concentrations still typically less than 12 mg/l across the whole year (CEFAS, 2016). This slight increase in comparison to the Hornsea Four array area is due to shallower water and being closer to the source of cliff erosion from the Holderness cliffs. Subtidal surficial sediments still appear to have a low content of fines and are unlikely to contribute to the slight increase.

6.1.3.24 Regional scale interpretations of bedload sediment transport suggest a change in the direction of the sediment pathway for the inshore area (west of the bedload parting), principally created by Flamborough Head quickening the flood tide, along with an increasing influence of waves across shallower depths (Kenyon & Cooper, 2005). The net direction of nearshore littoral drift is also northerly immediately in the lee of the headland, caused by the change in wave direction. These pathways create a local clockwise circulation that maintains Smithic Sands, a shallow profile sand deposit. The profile of the bank is around 5 to 6 m below CD and provides some coastal sheltering during periods of large waves.

Summary and Key Issues

6.1.3.25 The majority of the area of interest (Hornsea Four array area and offshore extents of the ECC) is represented by relatively deep water (30 to 50 m CD, approximately) that limits wave stirring influences on the local seabed. Tidal flows provide the main mechanism for sediment transport across a typically sandy seabed with small amounts of gravel and low content of fines. Sandwaves are noted in the north-west corner of the array area with alignments which support the influence of the tidal axis and with an asymmetry that indicates a net migration to the north-west. The low levels of fine sediments in sediments help keep suspended sediment concentrations low across the year.

6.1.3.26 In deeper water (> 50m CD) to the north of the Hornsea Four array area, the flows weaken and during summer periods temperature stratification occurs across the northern North Sea. The shallower waters to the south tend to be well-mixed. Between these two areas a seasonal temperature front known as the Flamborough Front develops from spring into summer but breaks down during more windy conditions from autumn into winter.

6.1.3.27 The inshore extents of the offshore ECC are considered as the area in the lee of Flamborough Head where water depths shallow up to the coast. Seabed sediments here are generally coarser than offshore and may reduce the development of sandwaves. The main sand deposit is Smithic Bank, formed in the lee of the headland by a local circulation and with a profile that is probably flattened by wave activity. Erosion from Holderness Cliffs provides a local source of fine sediments and beach material. Waves can stir the local seabed drive littoral drift which is in a northerly direction behind the headland. These processes provide slightly elevated levels of suspended sediment.

6.1.3.28 The physical process features that are considered as potential receptors are:

- Adjacent coastline, including Smithic Bank;
- Annex I sandbanks slightly covered by seawater all the time (specifically, North Norfolk Sandbanks and Saturn Reef SAC); and
- Flamborough Front.

6.1.4 Project Basis for Scoping Assessment

6.1.4.1 The physical process issues of Hornsea Four are being evaluated for each of the main stages of development, through construction, operation and decommissioning, with the scale of effects considered relative to the baseline condition.

6.1.4.2 During construction and installation of fixed assets (foundations and cables) onto and into the seabed the main issues are considered to relate to temporary and localised sediment disturbance events due to seabed preparation, sandwave clearance (including spoil disposals) and cable installation (including at the landfall). These events are likely to create periods of elevated levels of suspended sediments which may have a consequence to other environmental receptors. Decommissioning to remove installed assets is considered likely to have a similar effect.

6.1.4.3 The maximum design scenario for construction related issues involves the greatest volumes of disturbed sediment from all seabed preparation activities, including:

- levelling for Gravity Base Foundations (GBFs);
- drilling for monopiles;
- sandwave clearance for cable installation;
- spoil disposal of any material removed from the seabed during seabed preparation activities;
- jetting for cable installation of inter-array and export cables; and
- release of sediments from scour around foundations, if scour protection is not immediately deployed.

6.1.4.4 During operation of the wind farm (the longest phase of the development) the main consideration is a blockage effect from foundations on waves and flows which can lead to local scouring (if no scour protection is provided), the formation of wake effects (increases in turbulence, reduction and scattering of wave energy, etc) and the potential to modify sediment transport pathways. In the case of Hornsea Four, scour protection around foundations, at cable crossings and for areas which may require cable protection, forms part of the present project description, although the placement around foundations may be before or after installation.

6.1.4.5 The maximum design scenario for operational related issues involves the greatest number of closest spaced and widest foundations (i.e. GBF) that could potentially interfere with passing currents and waves as a blocking related effect.

6.1.4.6 The maximum design scenario for decommissioning related issues is effectively the same as for construction related seabed disturbance but also requires a consideration of seabed recovery.

6.1.5 Embedded Mitigation

6.1.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on physical processes. These are presented in Table 7-3. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in Annex A.

6.1.5.2 As there is a commitment to implementing these measures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in section 6.1.6 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

6.1.5.3 Scour protection is proposed around all foundations; however, the timing of placement may be after installation of the foundation units and once the scour process has reached an equilibrium. If scour protection is installed beforehand then this would provide embedded mitigation to any seabed sediments that would otherwise have been disturbed by scouring.

Table 6-2 - Relevant Physical Processes Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co44	Primary: The Holderness Inshore MCZ (designated for Intertidal sand and muddy sand, Moderate energy circalittoral rock, High energy circalittoral rock, Subtidal coarse sediment, Subtidal mixed sediments, Subtidal sand, Subtidal mud, and Spurn head (subtidal)) will be avoided by the offshore ECC.	Secured by means of the Order limits as defined in the DCO and dMLs.
Co45	Primary: The Holderness Offshore recommended MCZ (rMCZ) (proposed to be designated for North Sea Glacial Tunnel valleys, Subtidal coarse sediment, Subtidal sand, Subtidal mixed sediments and Ocean Quahog (*Arctica islandica*)) will be avoided by the offshore ECC.	Secured by means of the Order limits as defined in the DCO and dMLs.
Co82	Primary: A scour protection layer (typically rock) may be needed on the seabed and would be installed either before or after foundation installation.	Secured in the dMLs through the requirement for a SPMP.

6.1.6 Likely Significant Effects

6.1.6.1 Table 6-3 sets out an assessment of effects on marine geology, oceanography and physical processes at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.1.6.2 The assessment presented in Table 6-3 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 7-3, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for marine geology, oceanography and physical processes effects; relevant policy; the assessment criteria

provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified physical processes practitioners.

6.1.6.3 Table 6-3 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.1.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 6-3 - Likely Effects - Marine Geology, Oceanography and Physical Processes

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction and Decommissioning phase: Seabed levelling for GBF placement or sandwave clearance (for cable laying, etc) leading to removal of seabed material and requirements for spoil disposal	None	Negligible, short-term and spatially restricted	Location specific	**Likely significant effect without secondary mitigation** TBC: Project description details to be developed	Scoped In Simple assessment based on sites involved, with spoil volumes, particle size, water depths and current speeds. Assessment qualified against previous sediment plume modelling for Hornsea Project One, Hornsea Project Two and Hornsea Project Three.	None
Construction and Decommissioning phase: All direct sediment disturbance activities that may lead to increased suspended sediments (e.g. drilling, cable laying, seabed levelling, etc.)	Primary Co44 Co45	Negligible, short-term and spatially restricted	Location specific	**Likely significant effect without secondary mitigation** Project description details to be developed for excavation quantities and construction rates. Sediment material is likely to fall out of suspension relatively quickly.	Scoped In Simple assessment based on spoil volumes, particle size, water depths and current speeds. Assessment qualified against previous sediment plume modelling for Hornsea Project One, Hornsea Project Two and Hornsea Project Three.	None
Operation phase: Scouring around foundations	Primary Co82	Negligible, short-term and spatially restricted	Low	**No likely significant effect**	**Scoped Out**	None
Operation phase: Turbid wake effects from foundations interfering with Flamborough Front	None	Minor	Medium	**Likely significant effect without secondary mitigation** Flamborough Front is relatively close but also limited in position by deeper water to the north. The scale of any wake reaching the front needs to consider further details of the project description such as array layout and foundation spacing.	Scoped In Simple assessment based on magnitude and extents of wakes relative in proximity to the front and a consideration of the normal seasonal effects which restrict the front to summer periods.	None
Operation phase: Changes to waves affecting coastal morphology	None	Negligible	Medium	**Likely significant effect without secondary mitigation** Ddistance from Hornsea Four array area is expected to be sufficient so that any wave attenuation is fully dissipated before reaching the coastline	Scoped In Simple assessment based on determining relative scales of wave related blockage and compared to adjacent projects and qualified using previous wave modelling for Hornsea Project	None

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
					One, Hornsea Project Two and Hornsea Project Three.	
Operation phase: Changes to sediment pathways	None	Negligible	Medium	**No likely significant effect**	**Scoped Out**	None

6.1.6.5 Physical process features which will be assessed directly for a potential significant effect are limited to:

- adjacent coastline (including the Flamborough Head SAC): to establish the potential for a change in nearshore waves that could alter the baseline net littoral drift and local morphology; and
- Flamborough Front: to establish if the wake effects from structures have the capacity to extend to the area of the front and with a scale to destabilise the frontogenesis process.

6.1.6.6 The outcomes of comparable physical process assessments (based on the maximum development scenario) for Hornsea Project One, Hornsea Project Two and Hornsea Project Three each concluded that potential (blockage related) impacts to the shoreline, offshore sandbanks and the Flamborough Front would only result in effects of negligible or minor adverse significance (SMart Wind, 2013), (SMart Wind, 2015) and (Ørsted, 2018). The same outcome is expected for Hornsea Four given the comparable project description and physical setting. Given the outcomes presented by the Environmental Statement (ES) for Hornsea Project One, Hornsea Project Two and Hornsea Project Three, then such a proportionate approach based on a simple assessment of issues is merited for Hornsea Four.

6.1.6.7 An additional moderation for cumulative wave effects with Hornsea Project One and Hornsea Project Two is that both consented projects are now being constructed with a fewer number of foundations with far smaller diameters (i.e. monopiles rather than GBF) than the conservative assumptions applied in the ES based on the maximum design scenario.

6.1.7 Impacts Scoped Out of Assessment

Scouring around foundations

6.1.7.1 The option to place scour protection on the seabed prior to foundation installation would mitigate the scour process and the potential for seabed sediments to be locally eroded around any foundation. If this option is confirmed, then assessment of such scour can be scoped out since no scour will form.

Changes to sediment pathways

6.1.7.2 Previous assessments for Hornsea Project One, Hornsea Project Two and Hornsea Project Three have shown that impacts on sediment pathways are likely to be of minor adverse significance.

6.1.7.3 Given the anticipated localised nature of the changes in tidal currents and waves for Hornsea Four, there is anticipated to be no local or regional changes in the sediment transport regime. Furthermore, Hornsea Four is situated updrift in the sediment pathway

that is related to the Norfolk Banks SAC. On the basis of a proportionate approach, this issue is therefore scoped out.

6.1.8 Proposed Approach to the PEIR and ES

6.1.8.1 An evidence-based approach is advocated for the impact assessment of physical process issues that also remains proportionate to the anticipated levels of significance and to demonstrate that the possible relevance of issues has been considered. Simple assessments are proposed which will also refer to previous modelling of wave related effects. No further modelling is proposed.

6.1.8.2 A more in-depth literature review will be developed for the PEIR building on the initial outline provided in this Scoping section.

6.1.8.3 Specific details relating to the maximum development scenario will be used to demonstrate comparable influences on physical processes to those previously assessed for Hornsea Project One, Hornsea Project Two and Hornsea Project Three.

6.1.9 Scoping Questions for Consultees

6.1.9.1 Scoping questions for consultees in relation to marine geology, oceanography and physical processes include:

1. Do you agree that the data sources identified are sufficient to inform the physical processes baseline for the Hornsea Four PEIR and ES (and therefore that no further baseline data collection is merited)?
2. Have all physical process receptors and potential impacts that could result from Hornsea Four been identified?
3. Do you agree with the proposed approach to assessment (scoped in or out, and detailed or simple assessment) for each of the impacts in the Likely Significant Effects table for physical processes?
4. Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the relevant potential effects of Hornsea Four on physical processes?
5. Do you agree that, for those impacts scoped into assessment (at a detailed or simple level), the evidenced-based approach is sufficient to inform a robust impact assessment of physical processes for Hornsea Four, both for the project alone and cumulative impacts?

6.2 Subsea Noise

6.2.1 Introduction

6.2.1.1 This section of the Scoping Report addresses subsea noise sources of relevance to Hornsea Four. It is important to note that this section does not present consideration of any impacts to be scoped in or scoped out – this is undertaken in the receptor-based chapters. The purpose of this section is to provide a summary of underwater noise considerations.

6.2.1.2 Construction noise and vibration sources may include piling, hammering, dredging or drilling and will include the use of barges and vessels, and heavy machinery and generators on the vessels. Operational noise will include mechanical noise from the gearbox and generator of the turbines passing through the tower structure.

6.2.1.3 The subsea noise assessment will be included as an appendix to the PEIR and ES and will include an assessment of the level of subsea noise generated from Hornsea Four. Where applicable, the outputs of the subsea noise assessment will be used within impact assessment of the following receptor chapters:

- Chapter 6, section 6.4: Fish and Shellfish Ecology;
- Chapter 6, section 6.5: Marine Mammals;
- Chapter 6, section 6.8: Commercial Fisheries; and
- Chapter 6, section 6.12: Infrastructure and Other Users (specifically the assessment of seismic acquisition by the oil and gas industry).

6.2.1.4 The study area for the subsea noise assessment has therefore not been outlined within this section of the Scoping Report, as this is defined by the receptor and noted in the applicable sections of section 6.

6.2.2 Baseline Environment

6.2.2.1 Background noise sources within Hornsea Four, other than those that are naturally occurring, will arise primarily from shipping and the oil and gas industry. The shipping routes and shipping traffic is discussed in section 6.9: Shipping and Navigation and the oil and gas infrastructure and activities in the area are discussed in section 6.12: Infrastructure and Other Users.

6.2.3 Likely Significant Effects

Construction phase

6.2.3.1 As noted above, the effects of subsea noise during construction from piling of wind turbines and substations at Hornsea Four on marine mammals and fish are expected to be the key potential impacts and will be assessed further within the EIA. The assessments on identified receptors will be considered within the respective ES sections as outlined in section 6.5 for marine mammals, section 6.4 for fish and shellfish, section 6.8 for commercial fishing and section 6.12 for the oil and gas industry.

6.2.3.2 Mitigation will be built into the subsea noise modelling from piling soft starts, where an impact piling hammer starts at a relatively low blow energy before progressively increasing how hard the foundation is struck. The soft start procedure will be a key mitigation for minimising the potential impacts on sensitive receptors.

Operation and maintenance phase

6.2.3.3 Potential impacts during operation and maintenance, particularly from operational turbine noise and maintenance vessel noise, shall not be assessed further within the EIA. This aspect has been considered on recent offshore wind farm EIAs and not found to have a significant impact. There are no substantial developments to the design of Hornsea Four that would be likely to lead to a significant increase in noise during turbine operation. Therefore, this has been scoped out.

Decommissioning phase

6.2.3.4 Potential impacts, particularly from removal of infrastructure, shall be further assessed during the EIA. The assessments on identified receptors will be considered within the respective Environmental Statement chapters as outlined in **section 6.5** for marine mammals, **section 6.4** for fish and shellfish, **section 6.8** for commercial fishing and **section 6.12** for the oil and gas industry.

6.2.4 Proposed Approach to the PEIR

Overview

6.2.4.1 The subsea noise assessment will mainly consider the following legislation and guidance:

- The European Union (EU) Marine Strategy Framework Directive (Directive 2008/56/EC). This seeks to achieve Good Environmental Status (GES) in Europe's seas by 2020. The qualitative descriptors for determining GES include "Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment." This Directive has been transposed into UK law by the Marine Strategy Regulations 2010; and
- NPS EN-1 section 5.11, noise and vibration (DECC, 2011).

Data Sources

6.2.4.2 Subsea noise modelling was undertaken for Hornsea Project One, Hornsea Project Two and Hornsea Project Three, and these assessments shall be reviewed and used, where applicable, to inform the subsea noise assessment and modelling strategy for Hornsea Four.

Subsea noise modelling

6.2.4.3 Based on previous consultation on Hornsea Project One, Hornsea Project Two and Hornsea Project Three, a subsea noise assessment, including subsea noise propagation modelling, will be required for Hornsea Four. The exact scope, specification and methodology of the

noise propagation modelling will, however, be discussed and agreed with Statutory Nature Conservation Bodies (SNCBs) through the Evidence Plan process. However, on the basis of the requirements for the previous projects, it is anticipated that the subsea noise assessment will likely include:

- a review of the publicly available literature and studies of the impact of impulsive subsea noise on marine mammal and fish species, including an assessment of the sensitivity of fish and marine mammals to underwater sound, and derivation of criteria for estimating the impact to be agreed with the SNCBs;
- estimation of source level noise for impact piling operations at Hornsea Four (used as a realistic worst case);
- noise propagation modelling to estimate potential impact ranges for injury to marine mammals and fish as a result of piling during construction within the Hornsea Four array area and along the offshore Export Cable Corridor (ECC);
- noise propagation modelling to estimate potential impact ranges for behavioural effects to marine mammals and fish as a result of piling during construction within the Hornsea Four array area and along the offshore ECC;
- consideration of subsea noise effects associated with the operation and maintenance phase and decommissioning phases of Hornsea Four; and
- consideration of subsea sound propagation for concurrent piling operations at adjacent offshore wind farm developments.

6.2.4.4 The noise propagation modelling will consider the different construction scenarios which will allow the potential zone of influence from Hornsea Four (with respect to noise) to be mapped on both spatial and temporal scales. Where relevant, the subsea noise assessment will consider the potential effects associated with vessels piling simultaneously (see Chapter 3: Project Description) within Hornsea Four to the extent of significant sound propagation surrounding this area. This will allow the estimation of impact radii for fish and marine mammals using the area.

6.2.4.5 The impact radii will depend on the animals' specific sensitivity, the source level and properties of sound (e.g. frequency band, continuous or impulsive), sound radiation at the site and effect level. The assessments of injury and behavioural effects from Hornsea Four will be based on relevant published injury and behaviour thresholds for marine mammals and fish which will be discussed and agreed in advance with the SNCBs. It is expected that thresholds will primarily be derived from National Marine Fisheries Service (NMFS) (2018) in respect of marine mammals and Popper et al. (2014) in respect of fish.

6.3 Benthic and Intertidal Ecology

6.3.1 Introduction

6.3.1.1 This section of the Scoping Report identifies the benthic and intertidal ecology receptors of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components of Hornsea Four (i.e. seaward of MHWS) on benthic species and habitats.

6.3.2 Study Area

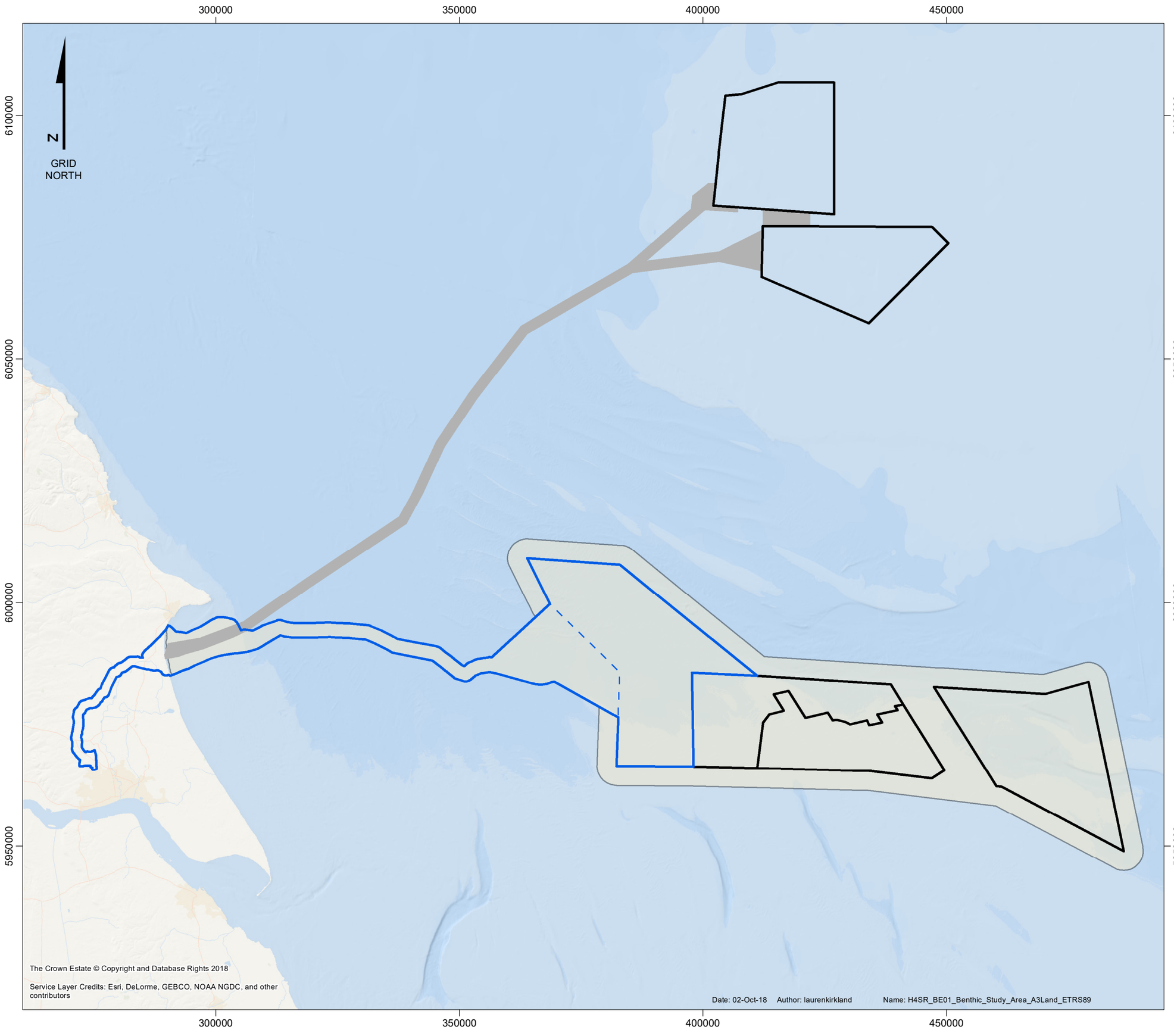
6.3.2.1 For the purposes of the Hornsea Four benthic and intertidal ecology characterisation, the study area is defined as the blue line displayed in **Figure 6-9**, that encompasses the Hornsea Four array area along with the Hornsea Project One, Hornsea Project Two and Hornsea Project Three array areas and a 5 km buffer zone to the north and south within which previous Hornsea sampling campaigns have been undertaken. The study area also includes the offshore ECC up to and including the intertidal zone ending at MHWS. Potential effects from construction, operation (including maintenance) and decommissioning of the offshore components of Hornsea Four on benthic and intertidal ecology.

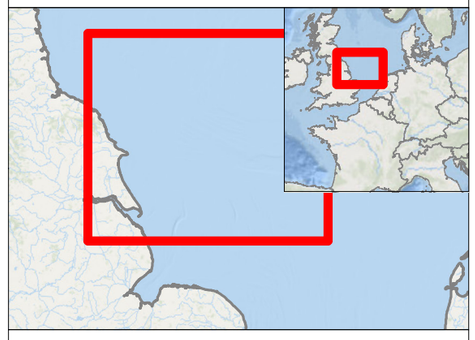
6.3.3 Baseline Environment

Datasets used for Scoping

6.3.3.1 A number of benthic and intertidal ecology datasets have been reviewed and collated to inform this scoping report. Data was drawn from Hornsea Zone Characterisation (ZoC) surveys and adjacent Hornsea Project One and Hornsea Project Two site specific surveys and from a desktop review of publicly available information. Data from within the inshore area of the offshore ECC were collated from surveys commissioned by Forewind to inform the EIA for the Dogger Bank Creyke Beck project. **Figure 6-9** presents the Creyke Beck offshore cable corridor and the area of overlap with the Hornsea Four ECC. **Figure 6-10** presents the sampling locations that coincide with the Hornsea Four array area and offshore ECC that were used to inform the benthic and intertidal baseline for the purposes of scoping. The datasets considered to be relevant to the Hornsea Four study area are listed in **Table 7-11** below.

Hornsea Four
Benthic Study Area
Figure 6.9





Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:750000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Benthic Study Area
Document no: H4SR_BE01
Created by: RM
Checked by: CC
Approved by: LK

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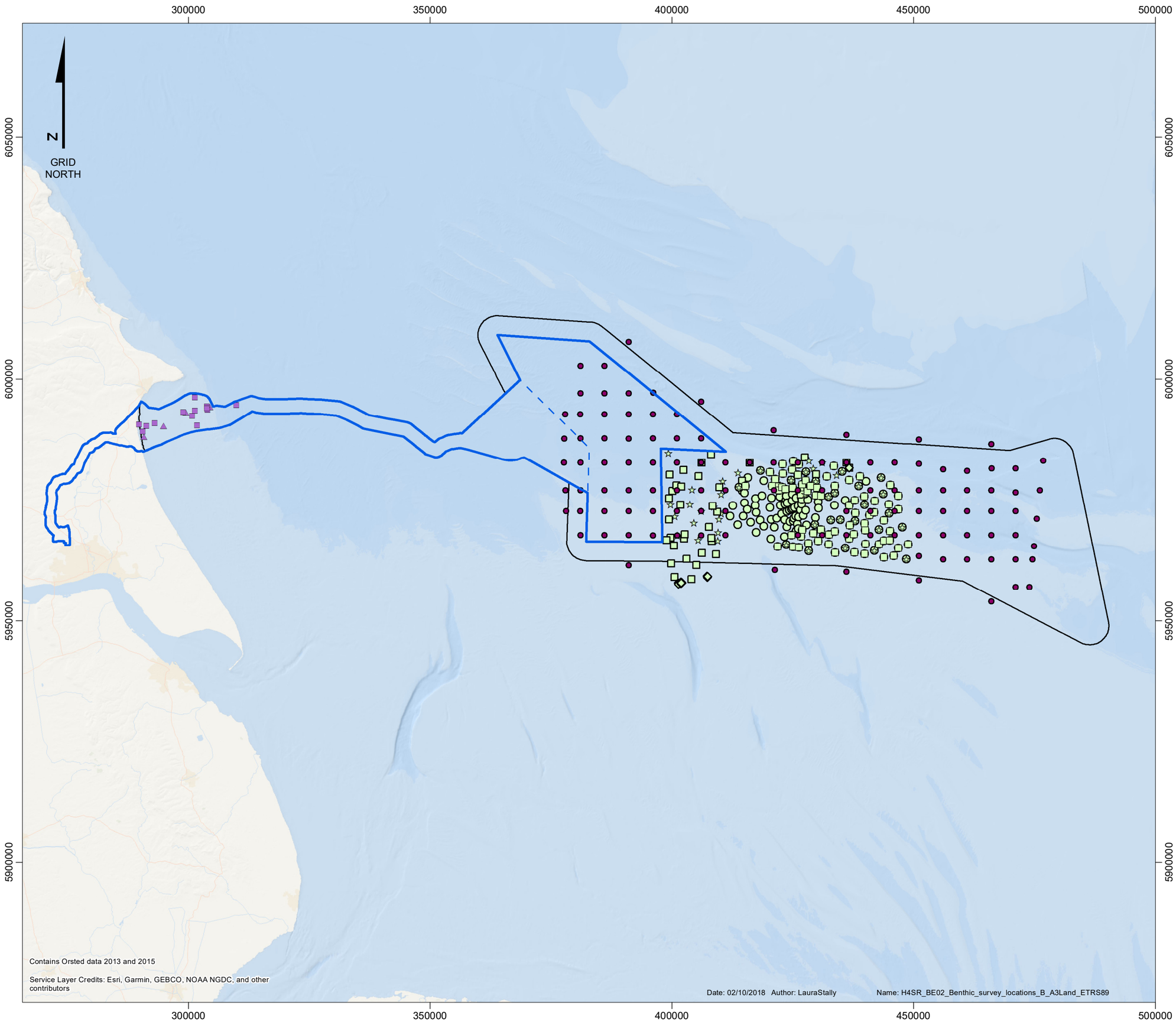
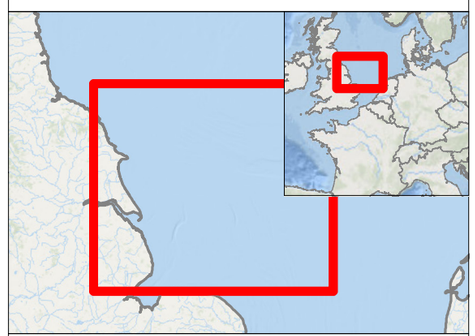
Hornsea Four
Benthic Survey Locations
Figure 6.10



- Scoping Boundary
- Array Area
- Former Hornsea Zone and Hornsea Project One Array Survey (2010 to 2011)
- Grab sample Location
- Creyke Beck Grab and DDV sampling location
- Creyke Beck beam trawl location
- Fish and Shellfish Study Area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:750000

0 4.5 9 18 27 36 Kilometres

0 2 4 8 12 Nautical Miles

Benthic Survey Locations
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Table 6-4 - Key sources of Benthic Ecology Data

Source	Summary	Coverage of Hornsea Four array area and ECC
Hornsea Zonal Characterisation Survey (2010)	Drop down video (DDV) and grab sampling gear were deployed across the former Hornsea Zone in a regular grid pattern applying a 5 km x 5km spacing to optimise sampling of the full range of habitats within the former Hornsea zone. An epibenthic beam trawl was also deployed at 11 stations within the Hornsea Four array area.	Full coverage of the Hornsea Four array area.
Hornsea One Array Survey (2010 - 2011)	An infill survey was undertaken at the Hornsea One array area deploying DDV and grab sampling gear. Epibenthic beam trawls were also deployed at a number of stations.	There is no overlap between the Hornsea One survey area and the Hornsea Four array area, however the data provides some regional context with regards to benthic habitat distribution.
Hornsea Project Two Array Survey (2012)	DDV and grab sampling gear were deployed across the Hornsea Two zone with a epibenthic beam trawl also deployed at a number of stations.	The survey targeted the Hornsea Two zone although some sampling stations were located on the periphery of the Hornsea Four array area.
Creyke Beck Environmental Statement (Forewind, 2013)	The Creyke Beck Environmental Statement, submitted as part of the Development Consent Order (DCO) application, presented an analysis of geophysical Acoustic Ground Discrimination System (AGDS) data ground truthed with benthic grab samples and drop down video to characterise the offshore array and export cable route to a landfall location on the Holderness coast. Intertidal surveys were also conducted at 2 potential landfall locations. Five transects were sampled within a 1 km corridor at each location following the sampling methodology set out in the Joint Nature Conservation Committee (JNCC) Marine Monitoring Handbook (Wyn & Brazier, 2001)	The inshore area of the Creyke Beck cable route coincides with the Offshore ECC for approximately 16 km from the landfall search area. Both intertidal landfall locations are within the Hornsea Four landfall area.
Humber Regional Environmental Characterisation (REC) (Tappin *et al.*, 2012)	Regional characterisation of wider Humber area including geophysical data, grab, epifaunal beam trawl and DDV ground truthing.	No overlap with Hornsea Four array area or offshore ECC. Closest sampling locations are located just beyond the southern boundary of the Hornsea Four array area. Dataset provides a regional context for site-specific information.

Source	Summary	Coverage of Hornsea Four array area and ECC
Technical reports for Strategic Environmental Assessment (SEA) Areas 2 and 3 (Department of Trade and Industry (DTI), 2001a; DTI,2001b);	Description of survey data published in the SEA for Areas 2 (northern North Sea) and 3 (southern North Sea).	Broadscale data with regional coverage.
EMODnet broad-scale seabed habitat map for Europe (EUSeaMap) (EMODnet, 2016[2])	EUSeaMap 2016 is a predictive habitat map which covers the seabed of a large area of European waters including the North Sea. Habitats are described in the European Nature Information System (EUNIS) and Marine Strategy Framework Directive (MSFD) predominant habitat classifications and predicted based on a number of physical parameters. Associated confidence maps are also available which give a break down confidence in predicted habitats into high, medium, and low.	Predictive maps are available for the full Hornsea Four array area and offshore ECC.
Hornsea Zonal Characterisation Survey (2010)	Drop down video (DDV) and grab sampling gear were deployed across the former Hornsea Zone in a regular grid pattern applying a 5 km x 5km spacing to optimise sampling of the full range of habitats within the former Hornsea zone. An epibenthic beam trawl was also deployed at 11 stations within the Hornsea Four array area.	Full coverage of the Hornsea Four array area.

6.3.3.2 A full analysis of the former Hornsea zone specific survey data is presented in the Hornsea Project Three Offshore Wind Farm Benthic Ecology Technical Report (Orsted, 2018a). The technical report presents an analysis of all data collected across the zone including the Hornsea Four array area and therefore has provided a useful description of the baseline information relevant to the Hornsea Four scoping exercise.

Overview of baseline environment

6.3.3.3 The data acquired from the ZoC, Hornsea Project One and Hornsea Project Two surveys were amalgamated and analysed to produce a combined infaunal and epifaunal biotope map. **Figure 6-11** presents the habitat distribution recorded across the benthic study area based on both the benthic infaunal and epifaunal datasets. The western most survey locations associated with the ZoC survey accounts for the greatest number of sampling stations within the Hornsea Four array area. The extant data has been used to characterise the benthic habitats within approximately 81 % of the Hornsea Four array area. The area is

[2] http://ww.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/

predominately characterised by infralittoral muddy sand with areas of circalittoral fine sand at the northern and south east periphery of the Hornsea Four array area. Further analysis of the grab samples was undertaken and predicted the component biotopes associated with the habitats to comprise SS.SSa.IMuSa.FfabMag (*Fabulina fabula and Magelona mirabilis with venerid bivalves and amphipods in infralittoral compacted fine muddy sand*) (A5.242) and SS.SSa.CFiSa.EpusOborApri (*Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand)* (A5.251).

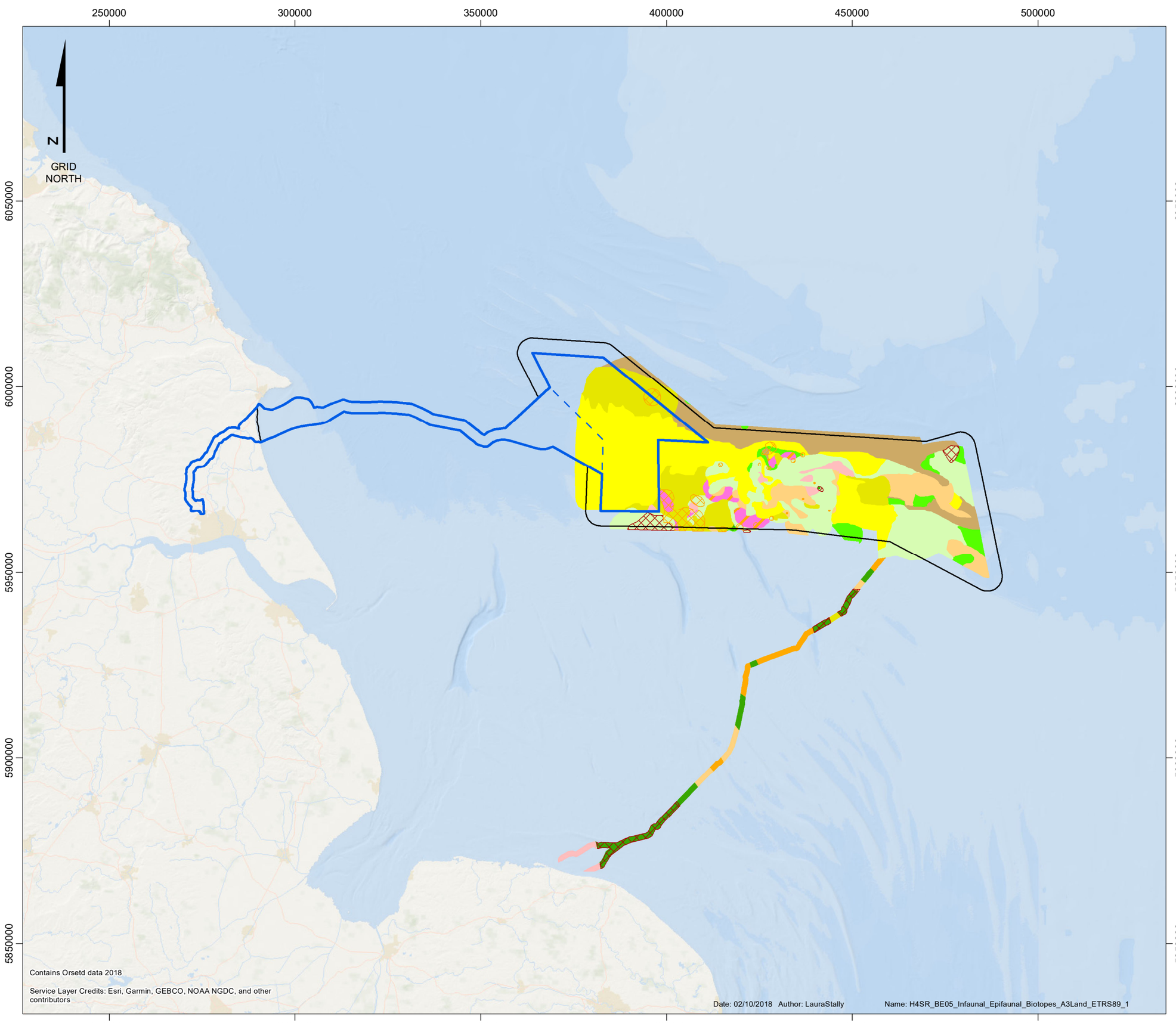
6.3.3.4 Other surveys conducted in the region such as the North Sea SEA surveys (Department of Energy and Climate Change (DECC), 2016) and the Humber REC (Tappin et al., 2011) recorded large areas of similar well-sorted medium or fine sands within the wider southern North Sea area.

6.3.3.5 The EUSeaMap project predicts habitats within the North Sea based on known environmental characteristics cross checked with extant survey data. The EUSeaMap predictions have been used to determine the anticipated habitat type along the offshore ECC in the absence of site specific information. The central and eastern sections of the offshore ECC is predicted to comprise of the same habitat type that covers the majority of the Hornsea Four array area based on the EUSeaMap predictions; Deep circalittoral sand (A5.27) (**Figure 6-12**). Although, this is the habitat predicted across the array area, in reality, site specific surveys indicate that the habitats recorded are more representative of EUNIS level four habitat infralittoral muddy sand (A5.24). It is anticipated that the habitat types along the eastern section of the offshore ECC will be similar to those known to be present within the array area.

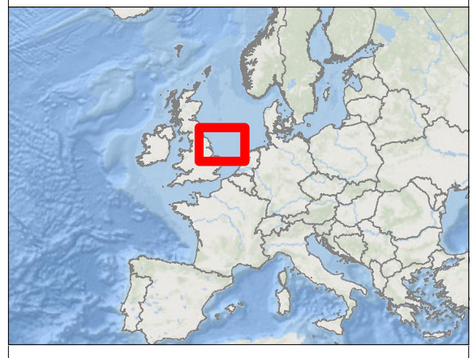
6.3.3.6 The benthic habitats along the nearshore sections of the offshore ECC are more heterogeneous with more coarse and mixed sediments predicted. The predicted EUNIS habitat types are deep circalittoral coarse sediment (A5.15), circalittoral coarse sediments (A5.14), deep circalittoral mixed sediments (A5.45) and infralittoral coarse sediments (A5.13). Close to shore the seabed habitats are predicted to exhibit a greater proportion of fine sediment comprising circalittoral fine sand (A5.25), circalittoral muddy sand (A5.26) and infralittoral fine sand (A5.23) or infralittoral muddy sand (A5.24). The confidence in the EUSeaMap predictions is moderate across the entire Hornsea Four array area and the majority of the offshore ECC.

6.3.3.7 The Dogger Bank Creyke Beck cable corridor partially overlaps with the offshore ECC for approximately 15 km from the landfall location. Habitat mapping conducted for Forewind's Creyke Beck Project has been used to characterise the inshore area of the offshore ECC where there is overlap with the Creyke Beck cable route (**Figure 6-13**).

Hornsea Four
Infaunal and Epifaunal Biotopes
Figure 6.11



- Scoping Boundary
- Array Area
- Benthic Study Area
- SS.SMx.CMx.FluHyd
- SS.SSa.IFiSa.ScupHyd
- SS.SBR.PoR.SspiMx
- SS.SBR.PoR.SspiMx
- SS.SCS.CCS.MedLumVen
- SS.SCS.CCS.MedLumVen / SS.SSa.CFiSa.EpusOborApri
- SS.SCS.ICS.MoeVen
- SS.SMX.OMx.PoVen
- SS.SMu.CSaMu.AfilMysAnit
- SS.SMx.CMx.MysThyMx
- SS.SSA.IFiSa.NcirBat
- SS.SSa.CFiSa.ApriBatPo
- SS.SSa.CFiSa.EpusOborApri
- SS.SSa.IMuSa.FfabMag



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:985000

0 5 10 20 30 40 Kilometres

0 6 12 24 Nautical Miles

Infaunal and Epifaunal Biotopes
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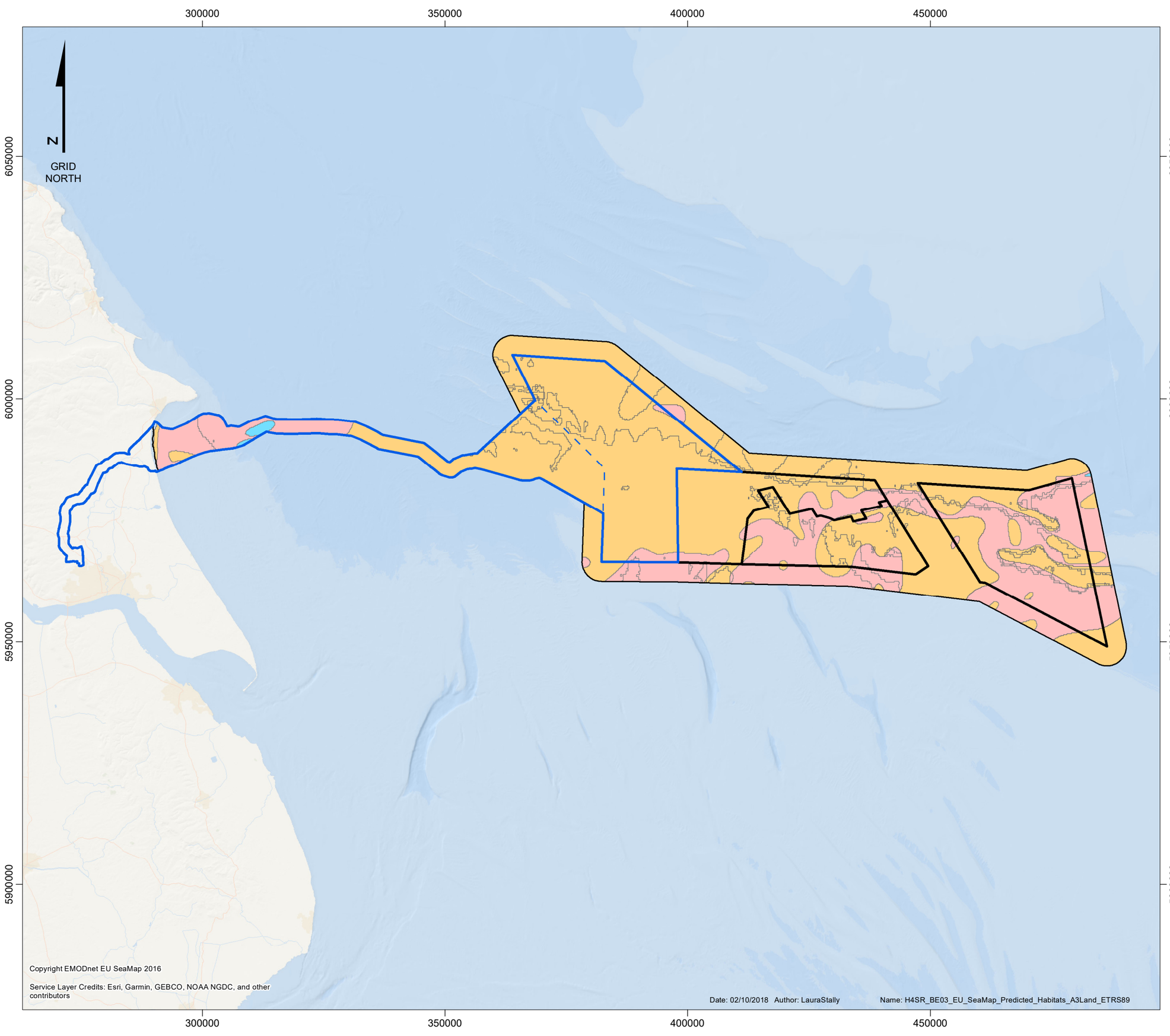
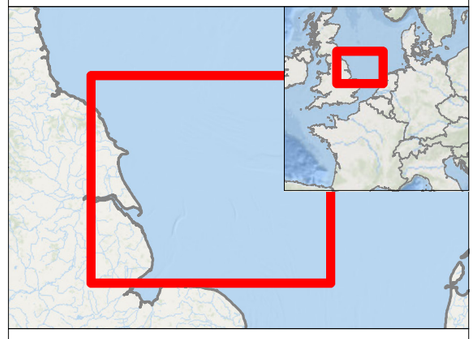
Hornsea Four
EU SeaMap Predicted Habitats
Figure 6.12



- Scoping Boundary
- Array Area
- Other Hornsea Projects
- Benthic Study Area
- EU SeaMap: Coarse sediment
- EU SeaMap: Mixed sediment
- EU SeaMap: Sand to muddy sand



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:750000

0 5 10 20 30 Kilometres

0 2 4 8 12 Nautical Miles

EU SeaMap Predicted Habitats
Document no: H4SR_BE04
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Approved by: LK

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Hornsea Four
Inshore Benthic Biotopes
Figure 6.13

280000 290000 300000 310000 320000 330000

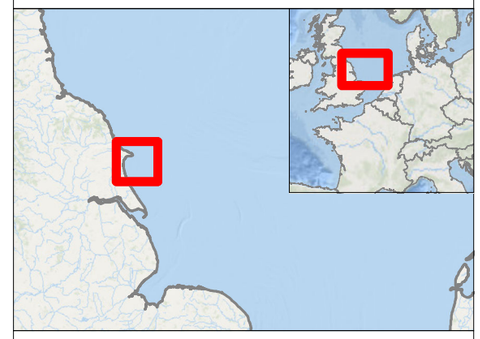
6010000 6000000 5990000 5980000

N
GRID NORTH

Scoping Boundary
Benthic Study Area
Envision Grab Sample Locations

Yorkshire Biotopes and Habitats Distribution:

- SS.SBR.SMus.MytSS
- SS.SMx.CMx.MysThyMx
- SS.SMx.CMx.MysThyMx/SS.SMu.CSaMu.Afil...
- SS.SSa.CFiSa.ApriBatPo/SS.SSa.IMuSa.Ffab...
- SS.SSa.CFiSa.EpusOborApri
- SS.SSa.CFiSa.EpusOborApri/SS.SSa.IFiSa.N...
- SS.SSa.CMx
- SS.SSa.IFiSa.NcirBat
- SS.SSa.SFiSa



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:182000

0 0.5 1 2 3 4 5 6 7 Kilometres

0 1 2 4 Nautical Miles

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Date: 02/10/2018 Author: LauraStally Name: H4SR_BE04_Inshore_Benthic_Biotopes_A3Land_ETRS89

Inshore Benthic Biotopes
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6.3.3.8 The habitats reported in the Creyke Beck ES broadly corroborate the predicted broadscale habitats identified from EUSeaMap which is characterised by a heterogeneous distribution of sedimentary habitats ranging from sand and mixed sediments to muddy sand sediments. Where the Creyke Beck cable route and offshore ECC overlap furthest offshore the dominant biotopes identified were *Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment (SS.SMx.CMx.MysThyMx) and *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri). Within approximately 8 km off the shore the Creyke Beck cable route was characterised by the biotopes *Mytilus edulis* beds on sublittoral sediment (SS.SBR.SMus.MytSS) and *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (SS.SSa.IFiSa.NcirBat).

6.3.3.9 With respect to offshore sediment contamination, the samples collected that coincide within the Hornsea Four array area and within the adjacent Hornsea project areas have demonstrated that contaminants are generally at levels that would not be of concern to the marine environment. During the Creyke Beck characterisation surveys five stations were sampled that coincide with the Hornsea Four offshore ECC. **Table 6-5** summarises the contaminant levels recorded against Cefas Action Level thresholds (Defra, 2003) and the Canadian interim Sediment Quality Guidelines (ISQG) (Canadian Council of Ministers of the Environment (CCME) 2002) at the five sampling locations within the Hornsea Four ECC. Raised levels of contaminants were recorded that exceeded Cefas Action Level 1 and ISQG Threshold Effect Levels (TELs). However, no locations exhibited contaminant levels at the higher Action Level 2 or Probable Effect Level (PEL) thresholds. Raised levels of these contaminants are not uncommon within the Humber region based on data held by the British Oceanographic Data Centre (BODC) in the Marine Environment Monitoring and Assessment National database (MERMAN).

Table 6-5 - Number of sampling stations within the offshore ECC with raised contaminant levels recorded during Creyke Beck characterisation surveys (Forewind, 2013)

Contaminant	Cefas Action Levels		Canadian ISQG	
	Action Level 1	Action Level 2	Threshold effect levels (TELs)	Probable Effect Levels (PELs)
Arsenic	0	0	0	0
Cadmium	4	0	2	0
Chromium	5	0	5	0
Copper	5	0	5	0
Mercury	0	0	0	0
Lead	3	0	3	0
Nickel	5	0	n/a	0
Acenaphthene	n/a	n/a	4	0
Ancenaphthylene	n/a	n/a	2	0
Anthracene	n/a	n/a	1	0
Benzo(a)anthracene	n/a	n/a	1	0
Benzo(a)pyrene	n/a	n/a	1	0
Chrysene	n/a	n/a	1	0
Dibenz(a,h)anthracene	n/a	n/a	3	0
Fluoranthene	n/a	n/a	1	0
Fluorene	n/a	n/a	2	0

Contaminant	Cefas Action Levels		Canadian ISQG	
	Action Level 1	Action Level 2	Threshold effect levels (TELs)	Probable Effect Levels (PELs)
Napthalene	n/a	n/a	3	0
Phenanthrene	n/a	n/a	3	0
Pyrene	n/a	n/a	1	0

6.3.3.10 The landfall area lies within the Holderness coast between Bridlington and Skipsea. Site-specific surveys were commissioned by Forewind to characterise the landfall location associated with the Creyke Beck electrical infrastructure. The Creyke Beck surveys found the landfall area to be characterised by long, clean sandy beaches, with cliffs at the upper shore. The intertidal biotopes were characterised by barren littoral sand (LS.LSa.MoSa.BarSa) with small areas of coarse sediment (LS.LCS) on the upper shore. Isolated artificial structures (concrete) are present on the shore at both potential landfall locations. JNCC reported highly mobile sediments subject to high degrees of drying between tides to be typical of the wider region (Connor *et al.* 2004).

Summary and Key Issues

6.3.3.11 The key benthic and intertidal ecology receptors within the benthic and intertidal ecology study area are identified as follows:

- Sandy sediments with low infaunal diversity and sparse epibenthic communities comprising the following biotopes:
  - SS.SSa.IMuSa.FfabMag (*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand);
  - SS.SSa.CFiSa.EpusOborApri (*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand); and,
  - *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (SS.SSa.IFiSa.NcirBat)
- Coarse and mixed sediments with moderate to high infaunal diversity and scour tolerant epibenthic communities:
  - *Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment (SS.SMx.CMx.MysThyMx); and,
  - *Mytilus edulis* beds on sublittoral sediment (SS.SBR.SMus.MytSS).
- Robust impoverished intertidal communities associated with high energy sediments:
  - *Barren littoral sand* (LS.LSa.MoSa.BarSa);
  - Small areas of coarse sediment (LS.LCS)

6.3.4 Project Basis for Scoping Assessment

6.3.4.1 The benthic and intertidal ecology scoping assessment is based on the construction and operation of the following project infrastructure:

- the construction of up to 180 wind turbine generators (WTGs) on a substructure foundation (varies depending on impact with associated seabed preparation and scour protection – but for habitat loss gravity-based foundations and associated seabed preparation);
- the construction of up to ten offshore substations, platforms, and accommodation platforms within the array area and up to three HVAC booster stations along the offshore ECC, all on gravity base structure foundations with associated seabed preparation and scour protection; and

- the construction of up to 6 offshore export cables, inter-array cables, up to 13 interconnector cables, and associated cable protection.

6.3.5 Embedded Mitigation

6.3.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on environmental receptors. These are presented in Table 6-6. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in Annex A.

6.3.5.2 As there is a commitment to implementing these measures, they have been considered in the assessment presented in Section 6.3.6 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

Table 6-6 - Relevant Benthic and Intertidal Ecology Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co44	Primary: The Holderness Inshore MCZ (designated for Intertidal sand and muddy sand, Moderate energy circalittoral rock, High energy circalittoral rock, Subtidal coarse sediment, Subtidal mixed sediments, Subtidal sand, Subtidal mud, and Spurn head (subtidal)) will be avoided by the offshore ECC.	Secured by means of the Order limits as defined in the DCO and dMLs.
Co45	Primary: The Holderness Offshore rMCZ (proposed to be designated for North Sea Glacial Tunnel valleys, Subtidal coarse sediment, Subtidal sand, Subtidal mixed sediments and Ocean Quahog (*Arctica islandica*)) will be avoided by the offshore ECR.	Secured by means of the Order limits as defined in the DCO and dMLs.
Co83	Primary: Undertake a cable burial risk assessment to inform front-end engineering works. Cable burial will be the preferred option for cable protection.	Secured in the dMLs through the requirement for a CSIP.
Co84	Primary: Foundations and cable routes will be micro-sited around qualifying sensitive habitat features (subject to agreement with the MMO) to an extent not resulting in a hazard for marine traffic and Search & Rescue capability. Presence of sensitive habitats will be identified through a review of the latest available benthic datasets and pre-construction surveys.	Secured in the dMLs through the requirement for a Design Plan.
Co86	Primary: The proposed offshore cable corridor and cable landfall (below MHWS) will avoid all statutory marine designated areas.	Secured by means of the Order limits as defined in the DCO and dMLs.
Co109	Tertiary: During piling operations, soft starts will be used, with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.	Secured in the dMLs through the requirement for a Marine Mammal Mitigation Protocol (MMMP).
Co111	Tertiary: A Project Environmental Management and Monitoring Plan (PEMMP) (construction and operation phases) and Decommissioning Plan (decommissioning phase) will be produced and followed. The PEMMP and Decommissioning Plan will cover the construction, operation and maintenance, and decommissioning phases of Hornsea Four respectively and will include a Marine Pollution Contingency Plan (MPCP). This MPCP	Secured in the dMLs through the requirement for a PEMMP and Decommissioning Programme.

Commitment ID	Measure Proposed	How the Measure will be Secured
	will outline procedures to protect personnel working and to safeguard the marine environment in the event of an accidental pollution event arising from offshore operations relating to Hornsea Four. The MPCP will also outline mitigation measures should an accidental spill occur, address potential contaminant releases and include key emergency contact details (e.g. Environment Agency, Natural England and the Maritime and Coastguard Agency (MCA)).	

6.3.6 Likely Significant Effects

6.3.6.1 Table 6-7 sets out an assessment of the effects on the benthic and intertidal ecology at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.3.6.2 The assessment presented in Table 6-7 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 6-6, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for benthic and intertidal ecology effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in Section 1.7; and the professional judgement of qualified benthic and intertidal ecologists.

6.3.6.3 Table 6-7 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.3.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

6.3.6.5 Sensitivity of biotopes and species described in the baseline environment are informed by the Marine Evidence based Sensitivity Assessment (MarESA)[3] developed by the Marine Life Information Network (MarLIN) team at the Marine Biological Association of the UK unless otherwise stated.

[3] https://www.marlin.ac.uk/sensitivity/sensitivity_rationale#toc_marine-evidence-based-sensitivity-assessment-maresa-approach

Table 6-7 - Likely Effects – Benthic and Intertidal Ecology

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction phase: Temporary habitat disturbance in the Hornsea Four array area and offshore ECC from construction activities	Primary Co44 Co45 Co84 Co86	Minor	Low or medium	**No likely significant effect**	**Scoped out**	None
Construction phase: Temporary habitat disturbance in the intertidal area from export cable installation	Primary Co44 Co45 Co84 Co86	Minor	Not sensitive	**No likely significant effect**	**Scoped out**	None
Construction phase: Temporary increase in SSC and sediment deposition in the Hornsea Four array area and offshore ECC	None	Minor	Low or medium	**No likely significant effect**	**Scoped out**	None
Construction phase: Temporary increase in SSC and sediment deposition in the intertidal area	None	Minor	Not sensitive	**No likely significant effect**	**Scoped out**	None
Construction phase: Impacts on benthic ecology from noise arising from foundation installation	Tertiary Co109	Minor	Not sensitive or Low	**No likely significant effect**	**Scoped out**	None
Construction phase: Direct and indirect seabed disturbances leading to the release of sediment contaminants	None	Negligible to low	Negligible	**No likely significant effect**	**Scoped out**	None
Construction phase: Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	Tertiary Co111	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operational phase: Long-term habitat loss/ change from the presence of foundations, scour protection and cable protection	Primary Co44 Co45 Co83 Co84 Co86	Negligible	Low (to potentially High)	**No likely significant effect**	**Scoped out**	None
Operational phase: Colonisation of the WTGs and scour/ cable protection may affect benthic ecology and biodiversity	None	Negligible	Low	**No likely significant effect**	**Scoped out**	None
Operational phase: Increased risk of introduction or spread of Marine Invasice Non-Native Species (MINNS) due to presence of subsea infrastructure and vessel movements (e.g. ballast water) may affect benthic ecology and biodiversity.	Tertiary Co111	Negligible	Medium	**No likely significant effect**	**Scoped out**	None
Operational phase: Direct disturbance to seabed from jack-up vessels and cable maintenance activities	Primary Co44 Co45 Co83 Co84 Co86	Negligible	Low to medium	**No likely significant effect**	**Scoped out**	None
Operational phase: Indirect disturbance to benthic species from EMF generated by inter-array and export cables	Primary Co83	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Operational phase: Changes to seabed habitats arising from effects on physical processes, including scour effects and changes in the sediment transport and	None	Minor	Low	**No likely significant effect**	**Scoped out**	None

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
wave regimes resulting in potential effects on benthic communities						
Operational phase: Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	Tertiary Co111	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Decommissioining phase: Temporary habitat disturbance from decommissioning of foundation substructures and cables	None	Minor	Low or medium	**No likely significant effect**	**Scoped out**	None
Decommissioining phase: Increased SSC and sediment deposition from removal of foundations and cables	None	Minor	Low to medium	**No likely significant effect**	**Scoped out**	None
Decommissioining phase: Loss of introduced habitat from the removal of foundations	None	Low	Low	**No likely significant effect**	**Scoped out**	None
Decommissioining phase: Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	Tertiary Co111	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None

6.3.7 Impacts Scoped Out of Assessment

Temporary habitat disturbance from construction activities in the Hornsea Four array area and offshore ECC from construction activities

6.3.7.1 The biotopes present within the Hornsea Four array area and most of the offshore ECC are characterised by sandy sediments with relatively low infaunal diversity and sparse epibenthic communities. The biotopes represent a continuum along depth and sediment gradients and exhibit similar responses to pressures, given the presence of similar species and functional groups. The habitats and component biotopes exhibit a moderate resistance to disturbance but have a high recoverability. The overall sensitivity is low. The exception is the biotope *Mytilus edulis* beds on sublittoral sediment (SS.SBR.SMus.MytSS) which has a sensitivity of medium.

6.3.7.2 Typically, the area impacted by construction activities for offshore wind farms affects a small proportion of the total area of seabed within the wind farm array area. Adjacent Hornsea projects have predicted that construction activities would disturb between 3.57% and 5.8% of seabed habitat within the respective development areas; temporary disturbance of the seabed for Hornsea Four is considered likely to be of similar magnitude to these adjacent projects. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA given the generally low sensitivity of the benthos and the small magnitude of the effect.

Temporary increase in SSC and sediment deposition in the Hornsea Four array area and offshore ECC

6.3.7.3 The impact to subtidal benthic receptors from drilling and seabed preparation for foundation installation and cable installation is likely to be of regional spatial extent (based on sediment plume modelling for Hornsea Project Three) and of medium term (i.e. construction phase of approximately one year for the Hornsea Four array area and approximately two years for the offshore ECC). However, only a limited number of construction activities will occur at one time and so these will be intermittent, and reversible to baseline conditions following cessation of activities. Coarse sediment materials will settle quickly upon resuspension while finer sediment particles are likely to disperse quickly with little accumulation of fine sediment (based on the results of the suspended sediment modelling undertaken for adjacent Hornsea projects (Orsted, 2018b)). Therefore, the impact of construction operations leading to increases in SSC and associated sediment deposition is predicted to be of local spatial extent, short term duration, intermittent and reversible. The magnitude is therefore, considered to be minor.

6.3.7.4 The majority of biotopes present within the Hornsea Four array area and offshore ECC are not considered sensitive to increased SSC. Increased SSC is a natural component of these habitats and the faunal communities are characterised by burrowing infauna. The sensitivity is therefore considered to be low. The exception is the biotope *Mytilus edulis* beds on sublittoral sediment (SS.SBR.SMus.MytSS) which has a sensitivity of medium to increased SSC. It is considered that there is no risk of likely significant effect given the generally low sensitivity and minor magnitude of effect and it is proposed that this impact be scoped out of the EIA.

Impacts on benthic ecology from noise arising from foundation installation

6.3.7.5 Benthic species are considered to be more susceptible to impacts resulting from the propagation of the particle motion component of anthropogenic noise. Field measurements on the propagation of particle motion is limited; however, it is expected that particle motion will dissipate in close proximity to the noise source resulting in a highly localised, temporary and intermittent impact with conditions returning to baseline following cessation of piling. Therefore, the magnitude is considered to be low.

6.3.7.6 There are currently few published studies on the reaction of benthic species to noise particularly infaunal bivalves and polychaetes that are typical of the biotopes present within the Hornsea Four array area and offshore ECC. The biotopes present within the array area and offshore ECC generally have a sparse epifaunal community. The MarESA sensitivity assessment suggest that the potential effects associated with the construction of a wind farm is 'not relevant' for the biotopes present. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Direct and indirect seabed disturbances leading to the release of sediment contaminants

6.3.7.7 Sediment chemistry analysis within the Hornsea Four array area recorded levels of contaminants that were below levels considered likely to cause significant effects to the benthic organisms. It is therefore unlikely that there will be any significant release of contaminants from sediments within the Hornsea Four array area. Raised levels of contaminants were noted in coastal areas, however, these levels were typical of the wider Humber region. Furthermore, the predominantly sandy nature of the seabed sediments at these locations significantly reduces both the potential for significant concentrations of contaminants to accumulate and for sediments to be re-suspended into the water column and transported over long distances, thus reducing the potential for far-field effects. Impacts will be temporary in nature and will return to the current baseline following cessation of construction activities. The magnitude of effect is considered negligible at the Hornsea Four array area and low along the offshore ECC.

6.3.7.8 The biotopes present within the Hornsea Four array area and the offshore ECC are considered to be tolerant of chemical pressures as presented in the MarESA assessment and are therefore assigned a negligible sensitivity. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.

6.3.7.9 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 the implementation of a project EMP. Therefore, the magnitude of this impact is considered to be negligible. The biotopes present within the Hornsea Four array area and the offshore ECC are considered to be tolerant of chemical pressures as presented in the MarESA assessment and are therefore assigned a negligible sensitivity. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Justification for scoping out operational impacts

Long-term habitat loss/ change from the presence of foundations, scour protection and cable protection

6.3.7.10 Habitat loss will occur within the footprint of the project infrastructure. Typically, this equates to a relatively small percentage of the overall project area, usually less than circa 1% of the total development area based on the EIA of other project in the southern North Sea. The adjacent Hornsea projects reported, in the respective ES's, that habitat loss would account for between 0.36 – 0.59% of the project development areas (SmartWind, 2013; 2015; Orsted, 2018b). The area of habitat loss is anticipated to be similar within the Hornsea Four array area and offshore ECC. The impact will therefore be local in extent, but permanent and irreversible throughout the duration of Hornsea Four. Prior to installation, a pre-construction survey will be undertaken, and data analysed to identify any sensitive receptors (i.e. habitats of high nature conservation interest) within the Hornsea Four array area and offshore ECC. Where practicable micro-siting of project infrastructure will be undertaken to minimise the risk to these high sensitivity benthic ecology receptors. The magnitude of this impact is therefore considered to be negligible. The permanent (for the duration of the development) The sensitivity of the majority of the prevailing benthos to small scale habitat loss is considered to be low (given that similar benthic communities occur over wider areas) but would be high for any benthos present with a high nature conservation value.

6.3.7.11 It is considered, given the embedded mitigation, that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Colonisation of the WTGs and scour/ cable protection may affect benthic ecology and biodiversity

6.3.7.12 The introduction of hard substrate, in the form of turbine and substation foundations, scour protection ad cable protection, and subsequent colonisation by subtidal invertebrate fauna will occur within the Hornsea Four array and offshore ECC area. This will result in a change in community type from species typical of sedimentary habitats to those typical of hard substrata. This may be considered a positive or negative effect. The change will be of limited spatial extent, although any effects will be permanent for the duration of the project (but will be reversible on decommissioning which assumes removal of the relevant infrastructure). Due to the limited spatial extent the magnitude is considered negligible. The biotopes within the Hornsea Four array area currently consist of those typical of sedimentary habitats; colonisation of species typical of hard substrate may increase the species diversity locally. The biotopes present are not, generally, considered to be of conservation importance. The sensitivity of the habitats present is therefore considered to be low. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Increased risk of introduction or spread of MINNS due to presence of subsea infrastructure and vessel movements (e.g. ballast water) may affect benthic ecology and biodiversity.

6.3.7.13 The potential risk of MINNS will be limited to subsea infrastructure which will provide a surface for colonisation; the potential for MINNS will be controlled by implementation of an appropriate project EMP which will set out biosecurity measures to minimise the risk of transfer of MINNS by operation and maintenance vessels. Therefore, the magnitude is considered to be negligible. Due to the predominance of sedimentary habitats across the

Hornsea Four array area and offshore ECC it is unlikely that much of the local epifauna will compete with MINNS colonising hard substrata. There is potential for MINNS to establish local communities on turbine substructure if introduced. The sensitivity is therefore considered to be medium. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Direct disturbance to seabed from jack-up vessels and cable maintenance activities

6.3.7.14 The magnitude will be of limited spatial extent and restricted to large component repairs which are anticipated to be infrequent. Therefore, any effects will be of short duration, temporary and intermittent with a high recoverability; the magnitude is considered to be negligible. As detailed above, the sensitivity of biotopes present in the Hornsea Four array area and offshore ECC will predominately be low (with the biotope *Mytilus edulis* beds on sublittoral sediment (SS.SBR.SMus.MytSS) within the nearshore section of the offshore ECC exhibiting a medium sensitivity). It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Indirect disturbance to benthic habitats from electromagnetic fields (EMFs) generated by inter-array and export cables

6.3.7.15 EMFs are likely to be generated by subsea cables and may be detectable above background levels in very close proximity to the cables. Although burial does not necessarily mask EMFs it increases the distance between species that may be affected by EMFs and the source. As the cable will be buried or protected across the majority of the Hornsea Four array area and offshore ECC any behavioural responses would be largely mitigated. The magnitude is therefore considered to be negligible. MarESA sensitivity assessments are not available for the habitats and species present within the Hornsea Four array area and offshore ECC. However, monitoring to date has not recorded any significant changes in invertebrate communities at existing offshore wind farms that have been attributed to EMF effects. In addition, benthic surveys of the Hornsea Four array area noted a sparse epifaunal community. It is considered unlikely that EMFs will result in a significant response that would cause a change in benthic communities within the Hornsea Four array area or offshore ECC. The sensitivity is therefore considered to be negligible. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Changes to seabed habitats arising from effects on physical processes, including scour effects and changes in the sediment transport and wave regimes resulting in potential effects on benthic communities

6.3.7.16 Hydrodynamic modelling at adjacent Hornsea projects has considered effects resulting from the presence of wind farm structures on marine processes and has indicated the measurable effects to be restricted to the immediate vicinity of turbines. Although the effects will be long-term and irreversible for the duration of the project the magnitude is considered to be minor. The species and biotopes present across the Hornsea Four array area are considered to be tolerant of changes to water flow and sediment movements at the scale predicted. The sensitivity is considered to be low. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.

6.3.7.17 As for the construction phase of the project, the risk of accidental spills will be managed through implementation of a project EMP with appropriate control measures and good housekeeping. The magnitude of this impact is therefore considered to be negligible. The biotopes present within the Hornsea Four array area and the offshore ECC are considered to be tolerant of chemical pressures as presented in the MarESA assessment and are therefore assigned a negligible sensitivity. It is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Justification for scoping out decommissioning impacts

Temporary habitat disturbance from removal of foundations and cables

6.3.7.18 The assessment of this impact will be synonymous with the assessment presented under the construction phase assessment above, noting that decommissioning will ultimately return the seabed habitats and associated benthos to a condition aligned with surrounding areas. As such it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Increased SSC and sediment deposition from removal of foundations and cables

6.3.7.19 The assessment of this impact will be synonymous with the assessment presented under the construction phase assessment above. As such it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Loss of introduced habitat from the removal of foundations

6.3.7.20 While the removal of the substrate will result in localised declines in biodiversity, areas of bare habitat, lost during construction and operation, will be exposed and will be open to recolonization by the surrounding infaunal and epifaunal benthic species. It is expected that the baseline benthic communities will recover in these areas to their pre-construction state based on the recovery rates for disturbed sediment. Magnitude is therefore considered to be low. As detailed above the sensitivity of biotopes present in the Hornsea Four array area will be low. It considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.

6.3.7.21 As detailed above for the construction and operation phase it is proposed that this impact be scoped out of the EIA.

Consideration of cumulative effects

6.3.7.22 The impacts detailed above are generally spatially restricted to within the Hornsea Four array area and offshore ECC. Due to tidal flows and wave action, increased SSC has the potential to go beyond the Hornsea Four array area or offshore ECC, however, previous modelling studies have indicated that settlement will occur quickly for coarser sediments and will disperse rapidly for finer sediment components. Furthermore, construction

programmes of adjacent projects are unlikely to overlap with the construction program for Hornsea Four.

6.3.7.23 Due to the limited spatial extent of most impacts and absence of a temporal overlap in construction it is considered that there is no risk of cumulative likely significant effects for the benthic and intertidal ecology impacts that have been scoped out.

6.3.8 Proposed Approach to the PEIR and ES

6.3.8.1 It is proposed to scope out of all the potential impacts on benthic ecology from any further consideration in the EIA process.

6.3.9 Scoping Questions for Consultees

6.3.9.1 Scoping questions for consultees in relation to benthic and intertidal ecology include:

1. Are you satisfied that the baseline data referenced above is valid for the purposes of the scoping assessment?
2. Do you agree that, considering the embedded mitigation in place, the assessment of benthic subtidal and intertidal ecology impacts as detailed above should be scoped out of the Hornsea Four EIA?
3. Do you agree that the cumulative effects on benthic subtidal and intertidal ecology receptors should be scoped out of the EIA for Hornsea Four based on the assumptions detailed in this Scoping Report?

6.4 Fish and Shellfish Ecology

6.4.1 Introduction

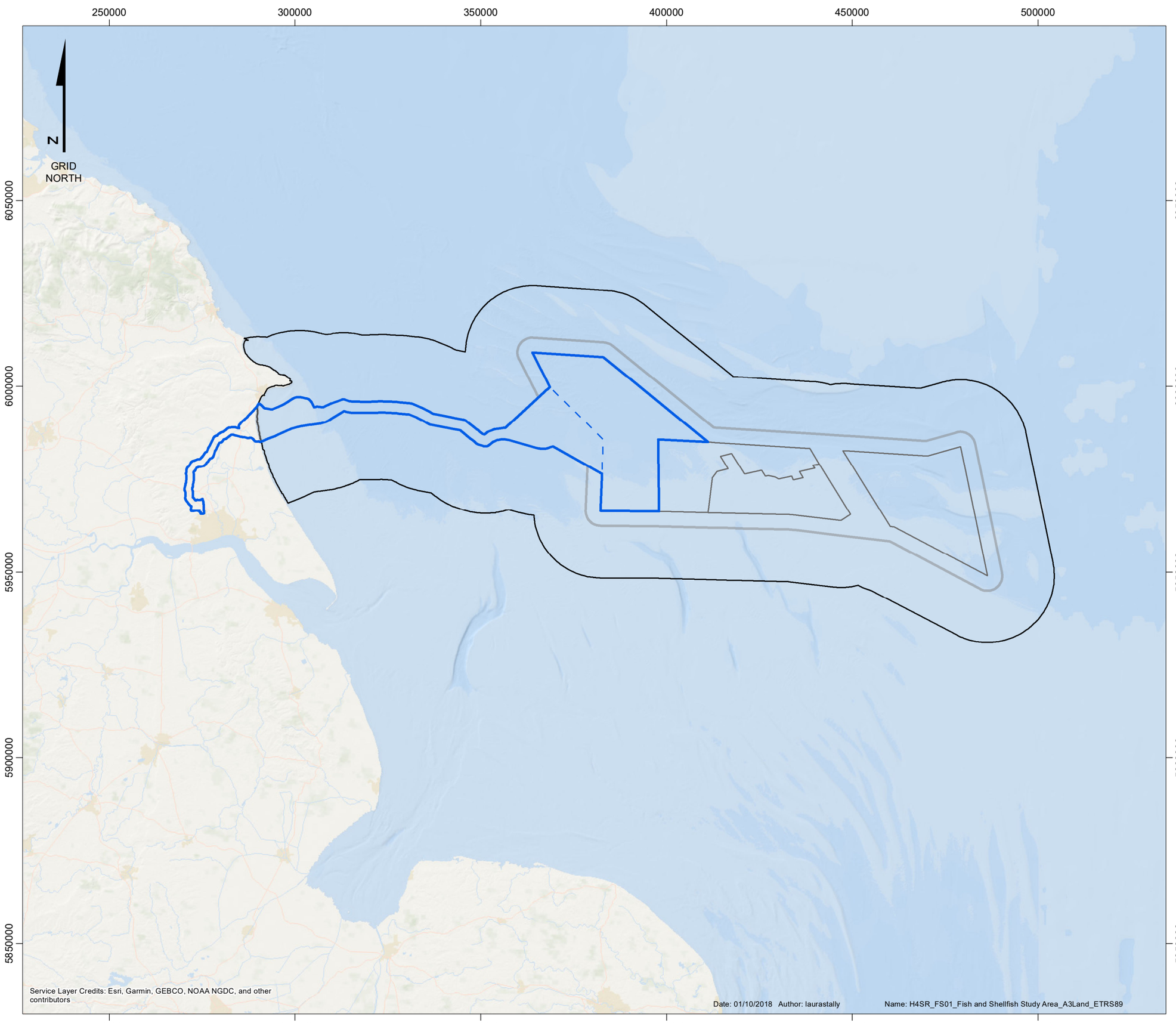
6.4.1.1 This section of the Scoping Report identifies the fish and shellfish receptors of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components of Hornsea Four on fish and shellfish ecology.

6.4.2 Study Area

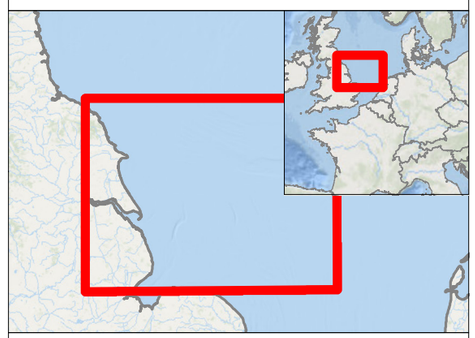
6.4.2.1 For the purposes of this fish and shellfish ecology scoping assessment, the study area has been defined at the following two spatial scales.

- The fish and shellfish survey area is shown in **Figure 6-14** and defined as the area encompassing the Hornsea Four array area including much of the wider former Hornsea Zone encompassing the Hornsea Project One, Hornsea Project Two and Hornsea Project Three areas plus a 4 km buffer which was surveyed as part of previous Hornsea survey campaigns. The local area also encompasses the Hornsea Four offshore ECC which is characterised using extant data sources as detailed in **section 6.3.3**.
- The wider spatial scale considers the fish and shellfish assemblage within an 18 km buffer around the array area and ECC. This wider area has been defined by the maximum tidal excursion recorded within the array area and offshore ECC and provides a wider regional context to the fish and shellfish baseline.

Hornsea Four
Fish and Shellfish Study Area
Figure 6.14



- Scoping Boundary
- Array Area
- Other Hornsea Projects
- Fish and Shellfish Local Study Area
- Fish and Shellfish Regional Study Area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:985000

0 5 10 20 30 40 Kilometres

0 4 8 16 24 Nautical Miles

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Date: 01/10/2018 Author: laurastally

Name: H4SR_FS01_Fish and Shellfish Study Area_A3Land_ETRS89

Fish and Shellfish Study Area
Document no: H4SR_FS_01
Created by: RM
Checked by: CC
Approved by: LK

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6.4.3 Baseline Environment

Data Sources Used for Scoping

6.4.3.1 A number of fish and shellfish datasets have been collated to inform this Scoping Report. Data was drawn from the Hornsea Zone Characterisation (ZoC) surveys and from the adjacent Hornsea Project One and Hornsea Project Two site specific surveys. A desktop review of publicly available information was also undertaken. Extant data collected within the nearshore area (within 8 km of the landfall location) of the offshore ECC was collated from surveys commissioned by Forewind to inform the EIA for the Dogger Bank Creyke Beck project. Figure 6-15 presents the location of sampling locations that coincide with the Hornsea Four array area and offshore ECC that have been used to inform the fish and shellfish baseline. The datasets considered to be relevant to Hornsea Four are listed in Table 6-8 below.

Table 6-8 - Key Sources of Fish and Shellfish Data

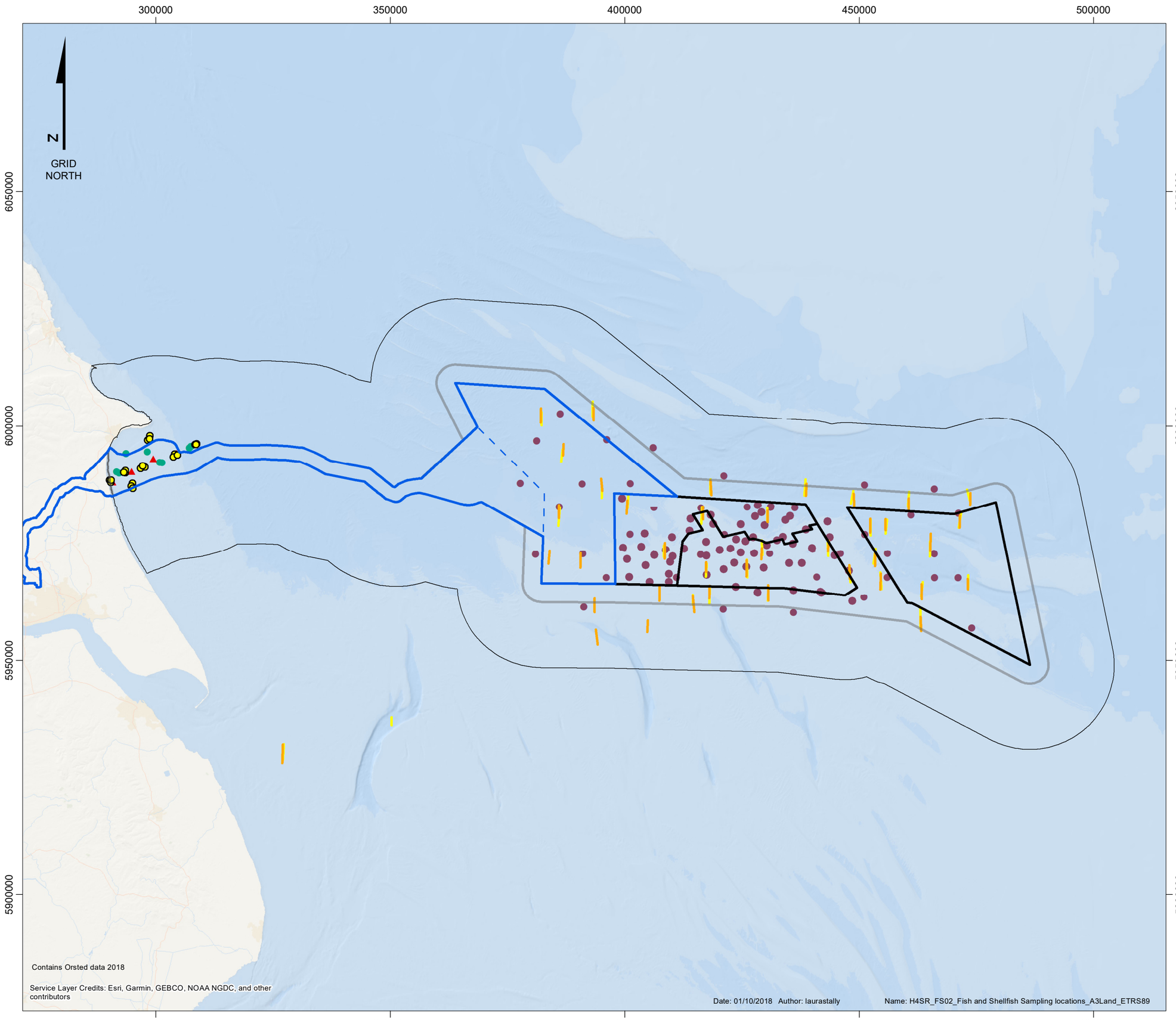
Source	Summary	Coverage of Hornsea Four array area and ECC
Hornsea ZoC Survey (2010 - 2011)	Otter trawl surveys comprising spring and autumn surveys conducted in 2011 using a high-opening 5 m otter trawl with a 40 mm cod-end designed to catch semi-pelagic as well as demersal species. An epibenthic beam trawl campaign was completed in November and December 2010 using a 2 m epibenthic beam trawl with a 5 m cod end.	The ZoC surveys were distributed across the whole former Hornsea zone. Within the Hornsea Four array area six otter trawl locations were sampled during each otter trawl campaign and nine epibenthic beam trawl sampling stations were sampled during the beam trawl campaign.
Hornsea Project One Array Survey (2010 - 2011)	An epibenthic beam trawl campaign was completed in July 2010 using a 2 m epibenthic beam trawl with a 5 m cod end.	The Hornsea Project One sampling locations are located to the east of the Hornsea Four array area. However, the data has been used to assess the regional distribution of fish and shellfish species.
Hornsea Project Two Array Survey (2012)	An epibenthic beam trawl campaign was completed in July 2012 using a 2 m epibenthic beam trawl with a 5 m cod end.	The Hornsea Project Two sampling locations are located to the east of the Hornsea Four array area. However, the data has been used to assess the regional distribution of fish and shellfish species.
Creyke Beck Environmental Statement (Forewind, 2013)	A number of surveys were conducted in the inshore area of the Creyke Beck cable route which coincides with the nearshore area of the offshore ECC. An inshore shellfish survey was carried out in August 2011 and January 2012 targeting six stations. At each	All potting fleets and trammel net fleets and eight of the 10 epibenthic beam trawl locations were located within the nearshore area of the offshore

Source	Summary	Coverage of Hornsea Four array area and ECC
	location a fleet of 22 standard pots plus five fine mesh pots were deployed. Three inshore trammel net surveys were completed in August 2011, January 2012 and January 2013. A fleet of three 100m long trammel nets comprising of an outer mesh panel of 635mm and an inner panel of 100mm mesh were deployed at seven stations. An epibenthic beam trawl survey was undertaken in November 2011. A 2 m epibenthic beam trawl with a 5 mm mesh cod end was deployed at 10 sampling stations.	ECC, from the landfall location to approximately 8 km offshore.
Fish spawning and nursery areas in UK waters (Coull *et al.*, 1998; Ellis *et al.*, 2012)	Both studies map the distribution of predicted spawning and nursery habitats of a number of key species in waters around the UK based on a review of extant data.	Provides fish nursery and spawning areas coincident with the Hornsea Four array area and offshore ECC.
Technical reports for Strategic Environmental Assessment (SEA) Areas 2 and 3 (Department of Trade and Industry (DTI), 2001a; DTI, 2001b);	Description of survey data published in the SEA for SEA Areas 2 (northern North Sea) and 3 (southern North Sea)	Broadscale data with regional coverage.
International herring larvae survey (IHLS)	The International Council for Exploration of the Seas (ICES) IHLS has been carried out since 1972 and covers most of the potential and historic spawning grounds of herring. The surveys are designed to provide a quantitative estimate of herring larval abundance to be used as a relative index of the changes in herring spawning stock biomass. A sampling grid is sampled regularly focusing on known spawning areas of herring.	Over the past 10 years sampling locations within the Hornsea Four array area have been sampled annually.
International bottom trawl survey (IBTS)	The North Sea IBTS is coordinated by the ICES International Bottom Trawl Survey Working Group (IBTSWG). The IBTSWG compiles survey data collected in spring and autumn undertaken by eight nations deploying demersal fishing gear to estimate stock abundance of commercially important demersal species.	Broadscale data that covers much of the North Sea including the Hornsea Four array area and offshore ECC.

6.4.3.2 A full analysis of the former Hornsea Zone site specific survey data is presented in the 'Hornsea Project 3 Offshore Wind Farm Fish and Shellfish Technical Report' (Orsted,

2018a). The technical report presents an analysis of all data collected across the zone including the Hornsea Four array area and therefore provides a useful reference point from which details on the baseline information relevant to the Hornsea Four scoping exercise can be drawn.

Hornsea Four
Fish and Shellfish Survey Locations
Figure 6.15



- Scoping Boundary
- Array Area
- Other Hornsea Projects
- Fish and Shellfish Study Area
- Scoping Area 18km buffer
- Creyke Beck trammel net location
- Creyke Beck beam trawl location
- Creyke Beck potting location
- Spring otter trawl location
- Autumn otter trawl location
- Epibenthic beam trawl location



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:6000000

0 5 10 20 30 40 Kilometres

0 25 50 100 150 Nautical Miles

Fish and Shellfish
Survey Locations
Document no: H4SR_FS_02
Created by: RM
Checked by: CC
Approved by: LK

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6.4.3.3 A detailed characterisation of the fish and shellfish communities within the former Hornsea Zone including the Hornsea Four array area and the wider southern North Sea fish and shellfish study area is presented in Volume 5, Annex 3.1 of the Environmental Statement (ES) for Hornsea Project Three (Orsted, 2018) from which the following summary is largely drawn.

6.4.3.4 A total of 84 fish species were recorded during the otter trawl and epibenthic beam trawl surveys conducted across the former Hornsea Zone between 2010 and 2012. Key characterising species comprised mainly demersal fish species such as whiting (*Merlangius merlangus*), dab (*Limanda limanda*), plaice (*Pleuronectes platessa*), solenette (*Buglossidium luteum*) and grey gurnard (*Eutrigla gurnardus*); these species were recorded in abundance during site-specific trawl surveys. Other less dominant demersal species recorded in the fish assemblage included lemon sole (*Microstomus kitt*), common sole (*Solea solea*) and cod (*Gadus morhua*). Small demersal species including the short spined sea scorpion (*Myoxocephalus scorpius*), lesser weaver (*Echiichthys vipera*), dragonet (*Callionymus lyra*) and scaldfish (*Arnoglossus laterna*) were also recorded in the site-specific surveys.

6.4.3.5 Pelagic species including herring (*Clupea harengus*), sprat (*Sprattus sprattus*) and squid (including European common squid (*Alloteuthis subulate*) and European squid (*Loligo vulgaris*)) were also frequently recorded during the otter and epibenthic beam trawl surveys.

6.4.3.6 Commercially important species encountered in high abundances and at high frequencies of occurrence during the surveys were whiting, dab, sprat, herring, plaice, mackerel (*Scomber scombrus*), and lemon sole. Other commercially important species including cod, haddock (*Melanogrammus aeglefinus*), sole, ling (*Molva molva*) and the spotted ray (*Raja montagui*), cuckoo ray (*Leucoraja naevus*) and thornback ray were encountered less frequently (less than 50% frequency) and at lower abundances.

6.4.3.7 The greater sandeel (*Hyperlopus lanceolatus*) and lesser sandeel (*Ammodytidae* spp.), (both keystone species as they are important prey items for fish, birds and marine mammals) were recorded during the surveys but generally at low abundances (and at less than 25% frequency). On the basis of sandeel habitats mapped by Jensen et al. (2010) using data collected from fishing vessels targeting sandeels in the North Sea, sandeel habitats occur within the former Hornsea Zone, including the area coinciding with the Hornsea Four array area. Chapter 6.8 Commercial Fisheries provides more information on the commercial fishery for sandeels within Hornsea Four.

6.4.3.8 Whilst not the primary intention of the otter trawl surveys, juvenile fish of the following species were recorded in moderate abundance; whiting, dab, herring, grey gurnard and lemon sole. No particular patterns in the distribution of these species were evident; juveniles were present at the majority of sites where adult fish were found.

6.4.3.9 The species recorded within the former Hornsea Zone are typical of those found within the wider southern North Sea (DTI, 2001a; DTI, 2001b; data from IBTS).

6.4.3.10 Table 6-9 details those species recorded during surveys within the fish and shellfish study area and any additional species that have the potential to be present based on wider regional datasets.

Table 6-9 - Species potentially present within the Hornsea Four array area or offshore ECC

Group / Species	
Pelagic	
Mackerel (*Scomber scombrus*)	Atlantic horse mackerel (*Trachurus trachurus*)
Sprat (*Sprattus sprattus*)	Shad (*Alosa* spp.)*
Blue whiting (*Micromesistius poutassou*)*	Atlantic salmon (*Salmo salar*)*
Herring (*Clupea harengus*)	Sea trout (*Salmo trutta*)*
Inshore / Coastal Species	
Catfish (*Anarhichas lupus*)*	Four-bearded rockling (*Enchelyopus cimbrius*)
Gobies (*Pomatoschistus* spp.)	Wrasses (*Labrus spp.*)*
Greater pipefish (*Syngnathus acus*)*	Short spined sea scorpion (*Myoxocephalus scorpius*)
Butterfish (*Pholis gunnellus*)	Scoprionfish (Scorpaenidae)
Scaldfish (*Arnoglossus laterna*)	Long-spined sea scorpion (*Taurulus bubalis*)
Lesser weaver (*Echiichthys vipera*)	
Demersal	
Whiting (*Merlnagius merlangus*)	Gurnards – Red (*Aspitrigla cuculus*)*
Lemon Sole (*Microstomus kitt*)	Gurnards – Grey (*Eutrigla gurnardus*)
Plaice (*Pleuronectes platessa*)	Gurnard – Tub (*Trigla lucerna*)
Turbot (*Scophthalmus maximus*)*	Red Mullet (*Mullus barbatus*)*
Halibut (*Hippoglossus hippoglossus*)*	Striped red mullet (*Mullus surmuletus*)
Long rough dab (*Hippoglossoides platessoides*) *	Monks or Anglers (*Lophius* spp.)*
American plaice (*Hippoglossoides platessoides*)	Lesser spotted dogfish (*Scyliorhinus canicular*)
Dab (*Limanda limanda*)	Tope (*Galeorhinus galeus*)*
Megrim (*Lepidorhombus whiffiagonis*)*	Thornback Ray (*Raja clavata*)
Witch (*Glyptocephalus cynoglossus*)*	Blonde Ray (*Raja brachyura*)*
Solenette (*Buglossidium luteum*)	Cuckoo Ray (*Raja naevus*)*
Sole (*Solea solea*)	Spotted ray (*Raja montagui*)
Thickback sole (*Microchirus variegatus*)	Starry smooth-hound (*Mustelus asterias*)
Norwegian topknot (*Phrynorhombus norvegicus*)	Saithe (*Pollachius virens*) *
Brill (*Scophthalmus rhombus*)	Pollack (*Pollachius pollachius*)*
Dragonet (*Callionymus lyra*)	Cod (*Gadhus morhua*)
Pogge (*Agonus cataphractus*)	Bass (*Dicentrarchus labrax*) *
Reticulated dragonet (*Callionymus reticulatis*)	European eel (*Anguilla anguilla*)*
Haddock (*Melangrammus aeglefinus*)	Sea lamprey (*Petromyzon marinus*)*
Hake (*Merluccius merluccius*)*	River lamprey (Lamprey fluviatilis)*
Ling (*Molva molva*)*	Conger Eels (*Conger* spp)*
Sandeels (*Ammodytes* spp.)	Pouting (*Trisopterus luscus*)
Greater sand eel (*Hyperoplus lanceolatus*)	Poor cod (*Trisopterus minutus*)
Shellfish	
Norwegian Lobster (*Nephrops norvegicus*)	Brown shrimp (*Crangon crangon*)
Lobster (*Homarus gammarus*)	Pink Shrimp (*Pandulus montagui*)
Brown crab (*Cancer pagurus*)	King scallops (*Pecten Maximus*)
Green Crab (*Carcinus maenus*)	Queen Scallops (*Aequipecten opercularis*)
Squat Lobster (*Munida rugosa*)	Whelks (*Buccinum undatum*)

Group / Species	
Velvet swimming crab (*Necora puber*)	European common squid (*Alloteuthis subulata*) Squid (*Loligo spp.*, Sepiola spp.)

(*) Species not recorded in surveys conducted within the Hornsea zone or the inshore Creyke Beck characterisation surveys but known to exist in the southern North Sea.

6.4.3.11 Spawning and nursery areas of a number of species have been identified in the vicinity of the Hornsea Four array area. **Table 6-10** details those species with spawning or nursery grounds that overlap with the Hornsea Four array area or offshore ECC. **Figure 6-16** to **Figure 6-20** present the spawning and nursery grounds of key species and the Hornsea trawl abundance data recorded during site specific surveys.

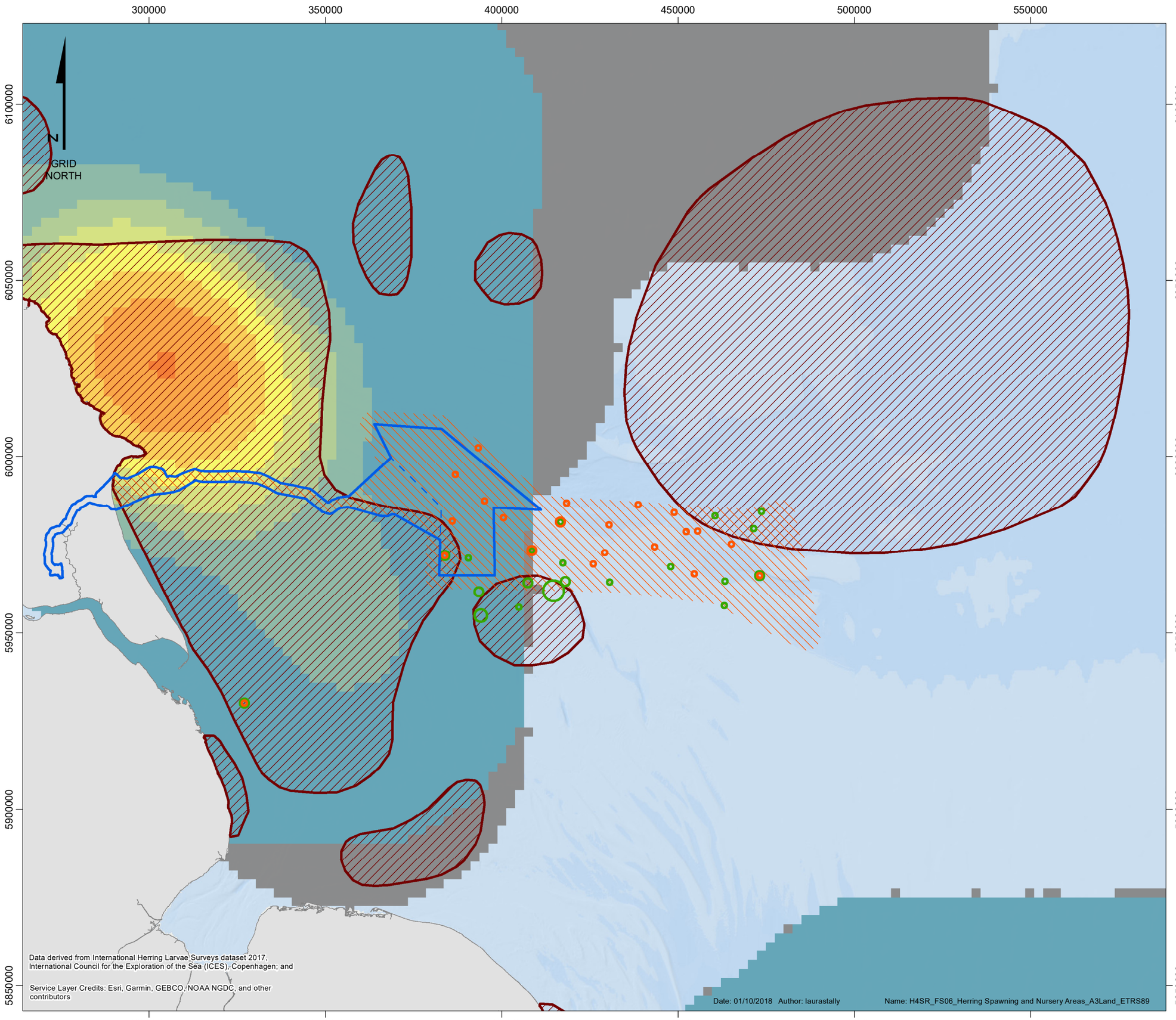
6.4.3.12 Herring and sandeel are of particular relevance when considering impacts to spawning areas as they are demersal spawners. Sandeel spawn in coarse sands to gravelly sands, whilst herring prefer to spawn in coarser sediments comprising sandy gravels to gravel.

6.4.3.13 Data from Coull et al. (1998) suggests that the Hornsea Four array area coincides with herring spawning grounds. However, data from the IHLS collected between 2007 and 2017 shows that the key spawning ground for this herring population (i.e. the Banks stock component) is located to the west of the former Hornsea Zone, off Flamborough Head. The IHLS data suggests that spawning areas around the Hornsea Four array area are therefore inactive with the majority of spawning adults aggregating closer to the coast. The offshore ECC coincides with this area of active spawning activity although the most active areas lie to the north of the offshore ECC. This population spawns in autumn, with peak spawning occurring in September and October. Gonadal assessment during the trawling surveys within the former Hornsea Zone did not confirm significant numbers of mature adult fish or spawning populations (0.5% of the herring caught in autumn were actively spawning).

6.4.3.14 Ellis *et al.* (2012) suggests high intensity sandeel spawning areas occur in the northern part of the Hornsea Four array area, with low intensity spawning and nursery coinciding with the remaining Hornsea Four array area and the offshore ECC. Spawning areas for sandeel off the east coast are large, extending from northern England down to the English Channel. It is also important to note that sediment type is considered an important determinant in the distribution of sandeel spawning habitat.

6.4.3.15 Although spawning grounds for other species coincide with the Hornsea Four array area and offshore ECC, these are generally part of a far larger spawning area that covers large parts of the southern North Sea. Furthermore, pelagic spawners rely less on demersal habitats for recruitment and are therefore, less at risk from any impacts to the seabed. The Hornsea Four array area and offshore ECC coincides with the southern periphery of high intensity whiting nursery grounds (**Figure 6-18**), however, this is part of a large area of nursery grounds that extends up the east coast of the UK to the north coast of Scotland.

Hornsea Four
Herring Spawning and Nursery Areas and Hornsea Trawl Abundance
Figure 6.16



Scoping Boundary

Array Area

Fish and Shellfish Study Area

Coull et al. (1998)

Undetermined Intensity

Total larvae per m^2 (International Herring Larvae Surveys 2007/08-2016/17)

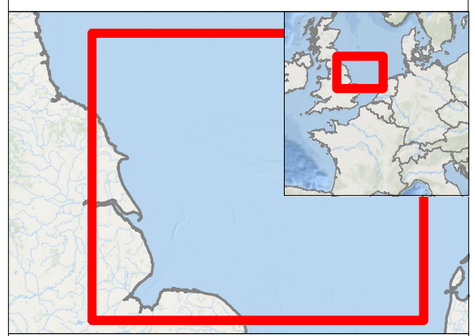
- 0
- 0.1 - 7,000
- 7,000.1 - 24,500
- 24,500.1 - 45,500
- 45,500.1 - 69,000
- 69,000.1 - 97,500
- 97,500.1 - 133,000
- 133,000.1 - 175,000
- 175,000.1 - 220,500

Otter Trawl Abundance per 500m - Autumn

- 0
- 0.01-50
- 50-100
- 100-250
- 250-500
- 500-1000

Otter Trawl Abundance per 500m - Spring

- 0
- 0-50
- 50-100
- 100-250
- 250-500
- 500-1000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:1037507

0 5 10 20 30 40 Kilometres

0 4 8 16 24 Nautical Miles

Herring Spawning and Nursery Areas and Hornsea Trawl Abundance
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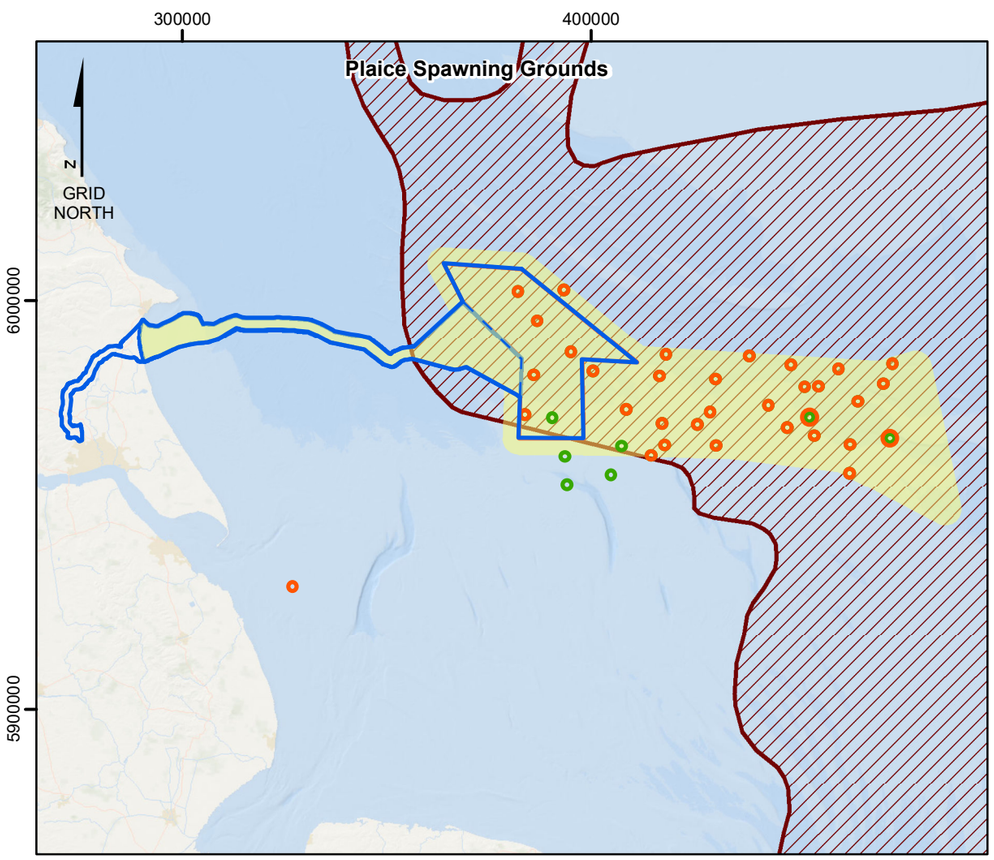
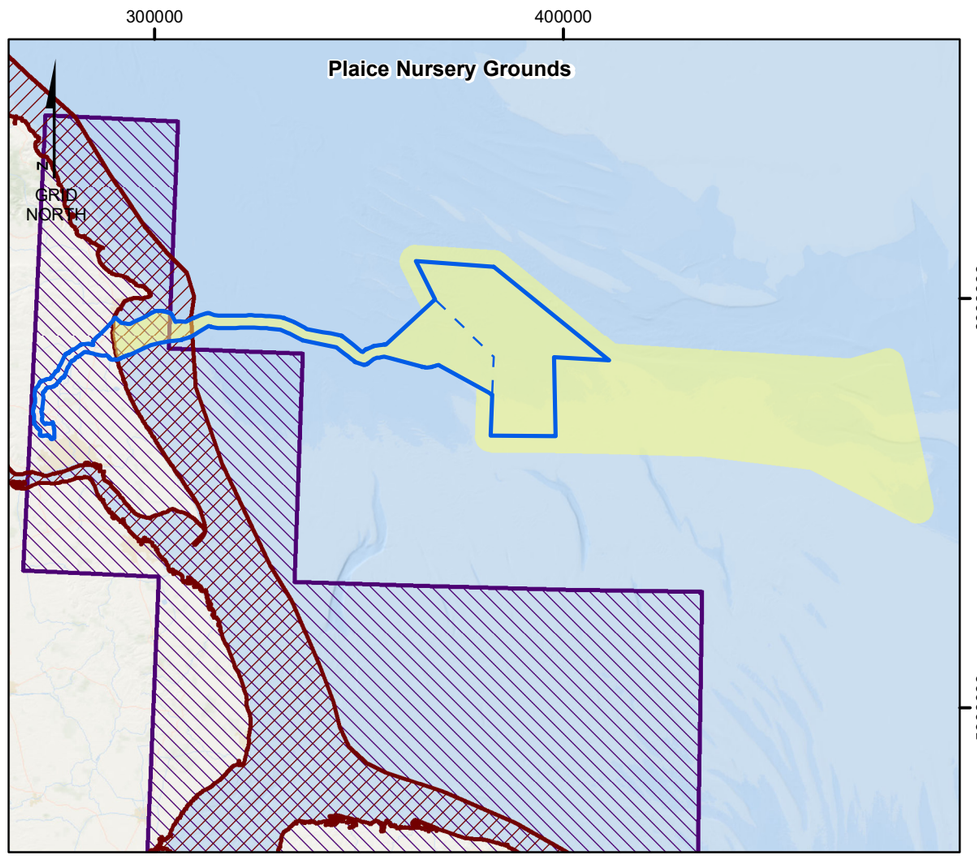
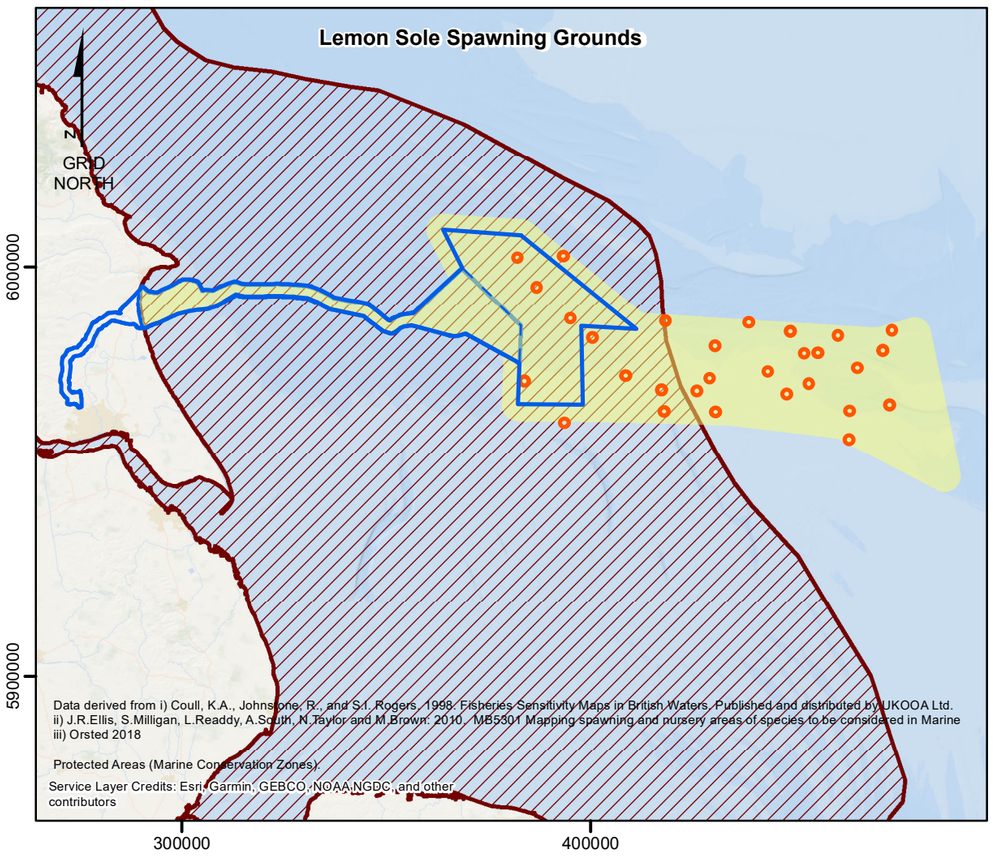
Hornsea Four

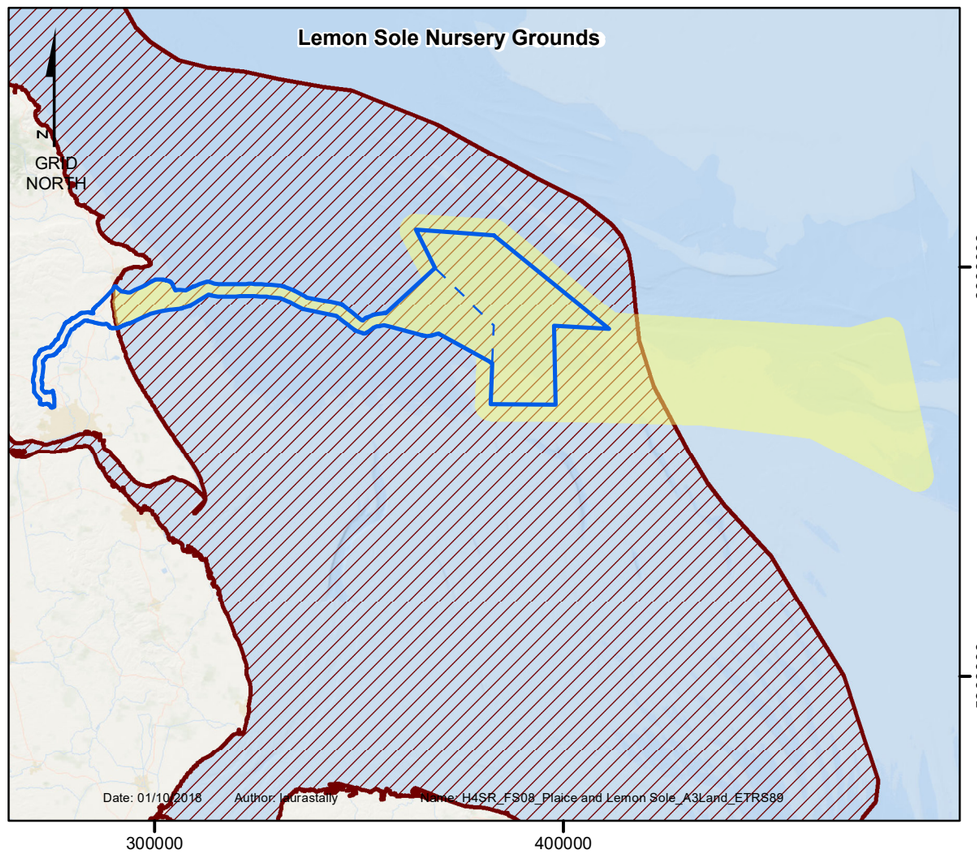
Plaice and Lemon Sole Spawning and Nursery Areas and Hornsea Trawl Abundance

Figure 6.17









Scoping Boundary

Array Area

Fish and Shellfish Study Area

Spawning / Nursey Grounds (Coull et al., 1998)

- High Intensity
- Low Intensity
- Undetermined Intensity

Otter Trawl Abundance per 500m - Spring

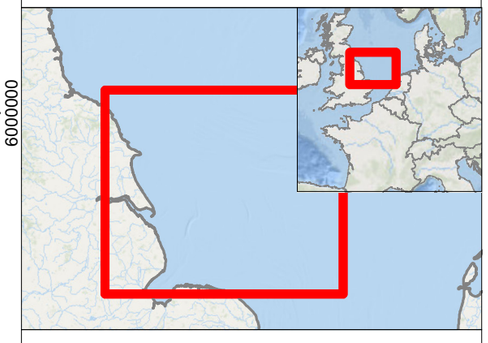
- 0
- 0-50
- 50-100
- 100-250
- 250-500
- 500-1000

Spawning / Nursey Grounds (Ellis et al., 2010)

- High Intensity
- Low Intensity

Otter Trawl Abundance per 500m - Autumn

- 0
- 0.01-50
- 50-100
- 100-250
- 250-500
- 500-1000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:2013000

0 10 20 40 60 80 100 Kilometres

0 4 8 16 24 32 40 Nautical Miles

Plaice and Lemon Sole Spawning and Nursery Areas and Hornsea Trawl Abundance
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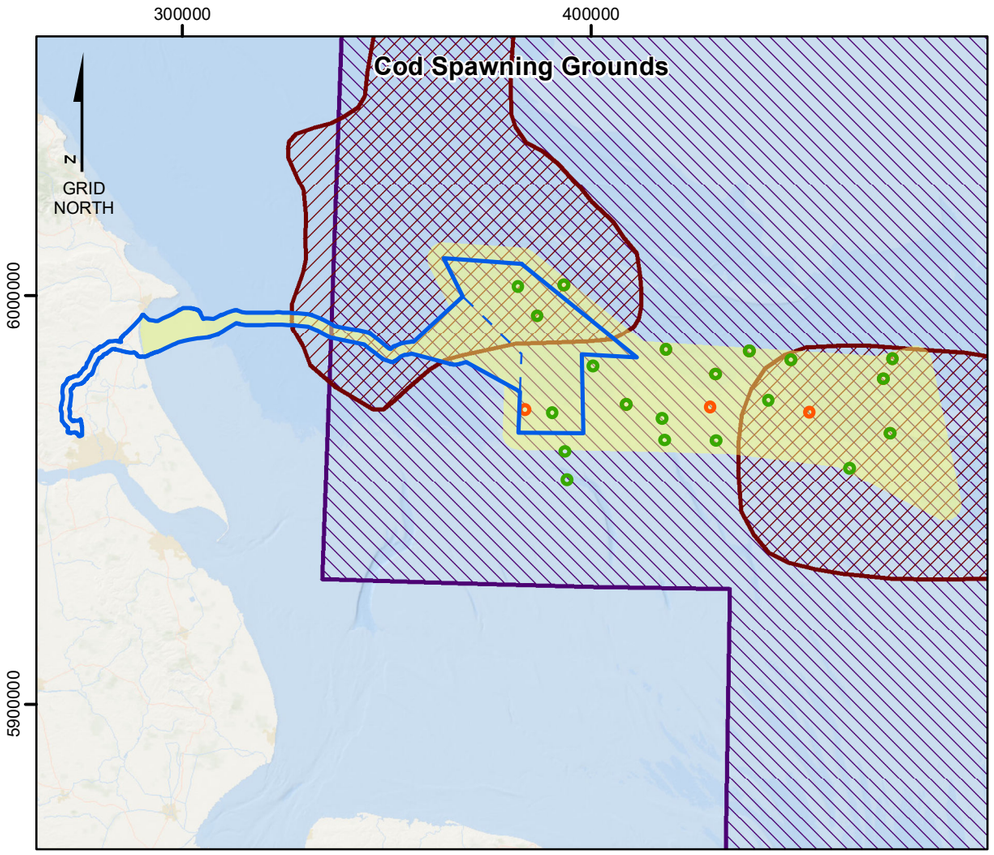
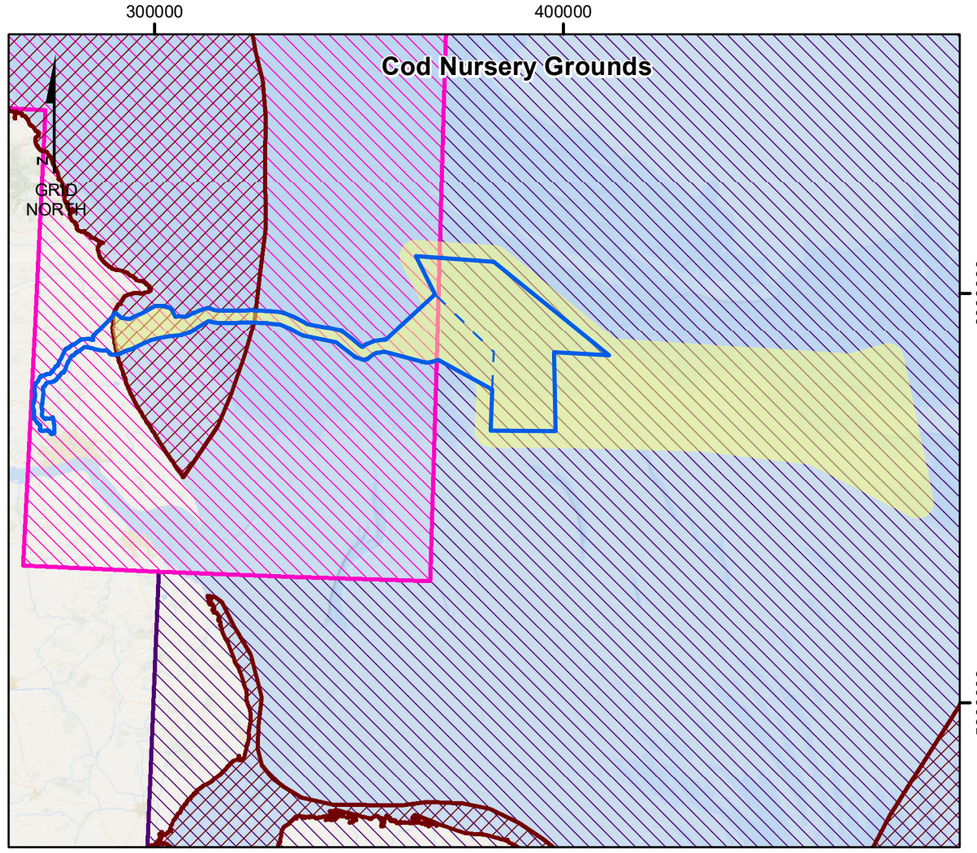
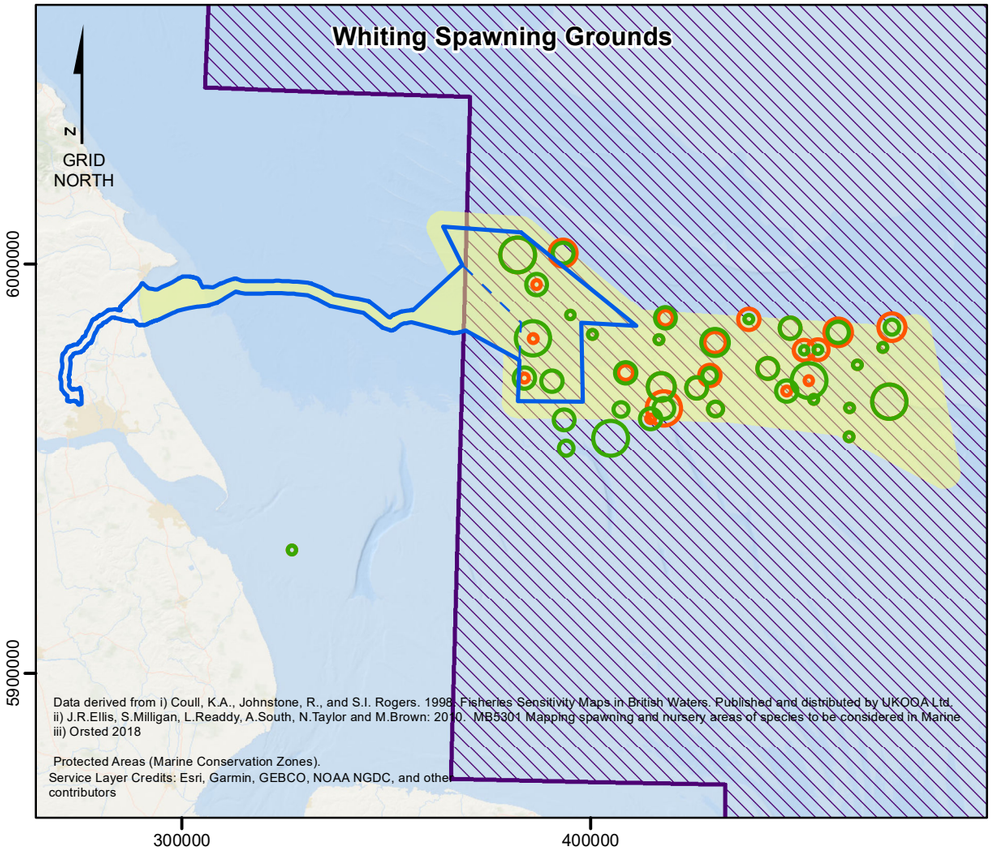
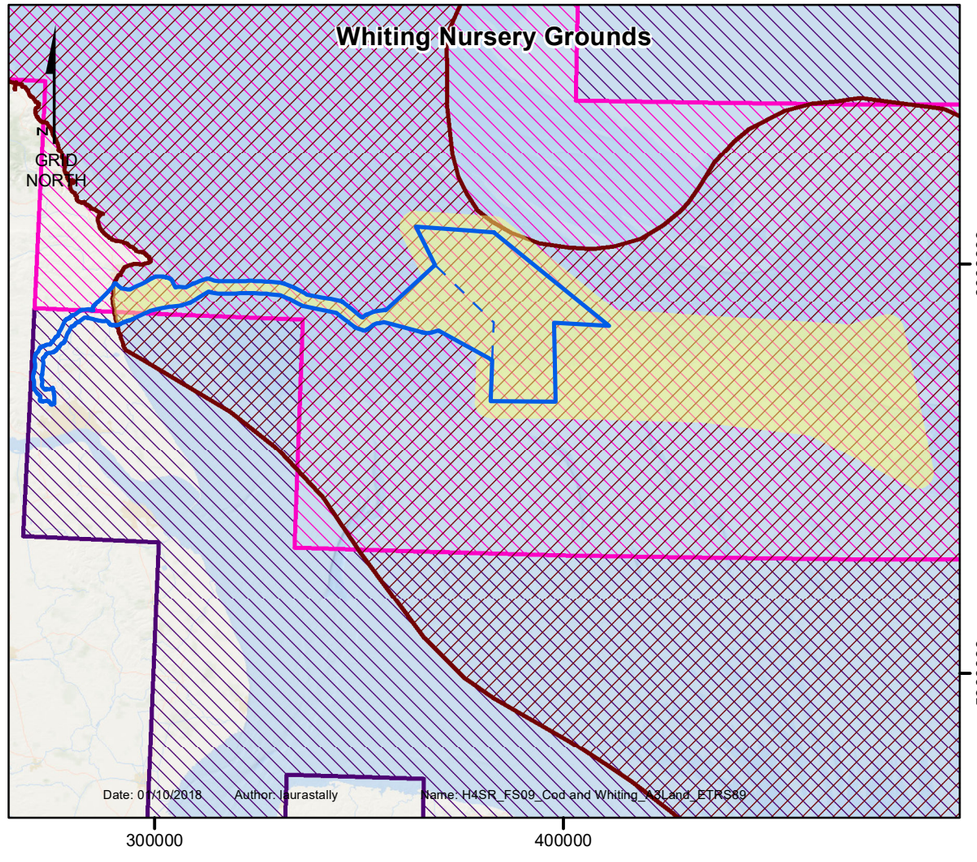
Hornsea Four
Cod and Whiting Spawning and Nursery Areas and Hornsea Trawl Abundance
Figure 6.18









Scoping Boundary

Array Area

Fish and Shellfish Study Area

Spawning / Nursey Grounds (Coull et al., 1998)

- High Intensity
- Low Intensity
- Undetermined Intensity

Otter Trawl Abundance per 500m - Spring

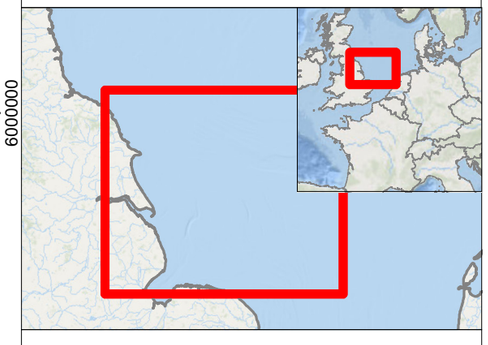
- 0
- 0-50
- 50-100
- 100-250
- 250-500
- 500-1000

Spawning / Nursey Grounds (Ellis et al., 2010)

- High Intensity
- Low Intensity

Otter Trawl Abundance per 500m - Autumn

- 0
- 0.01-50
- 50-100
- 100-250
- 250-500
- 500-1000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:2013000

0 10 20 40 60 80 100 Kilometres

0 6 12 24 36 Nautical Miles

Cod and Whiting Spawning and Nursery Areas and Hornsea Trawl Abundance
Document no: H4SR_FS09
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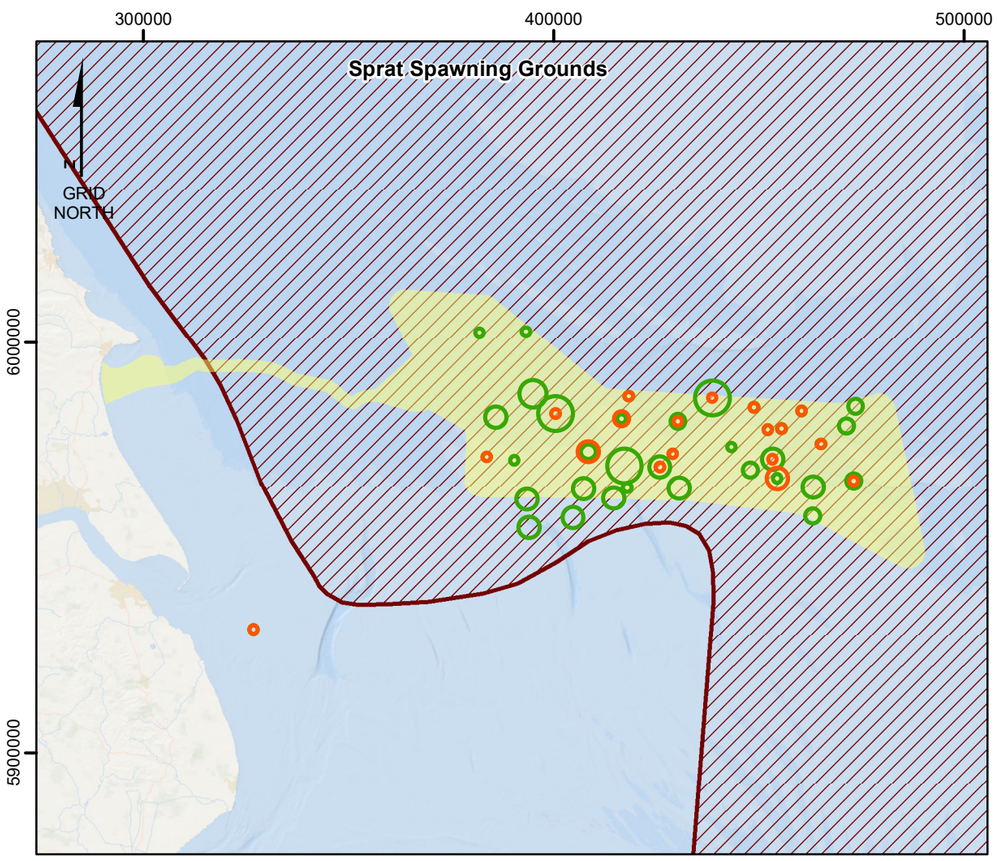
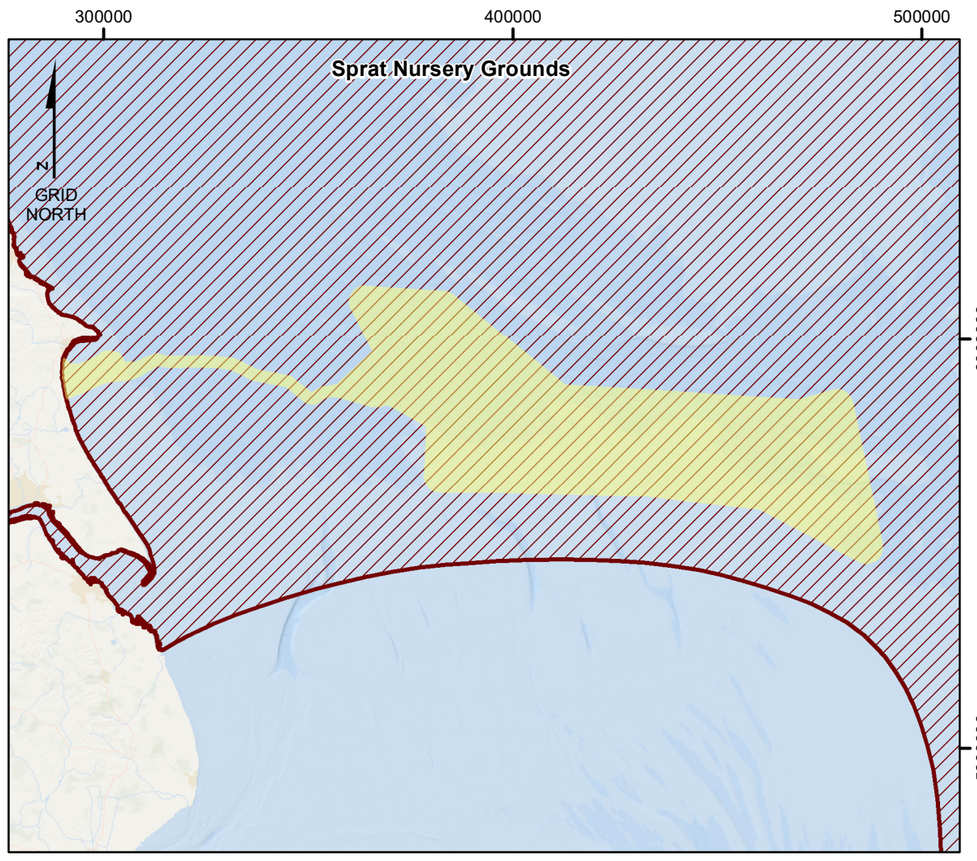
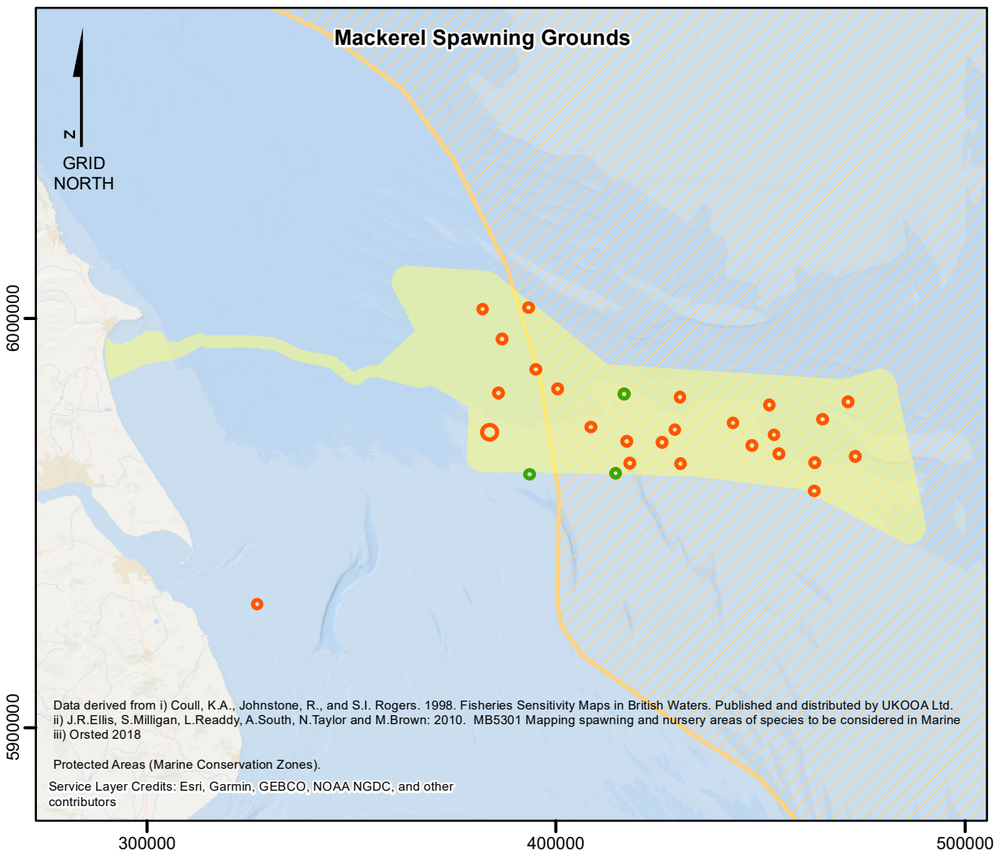
Hornsea Four

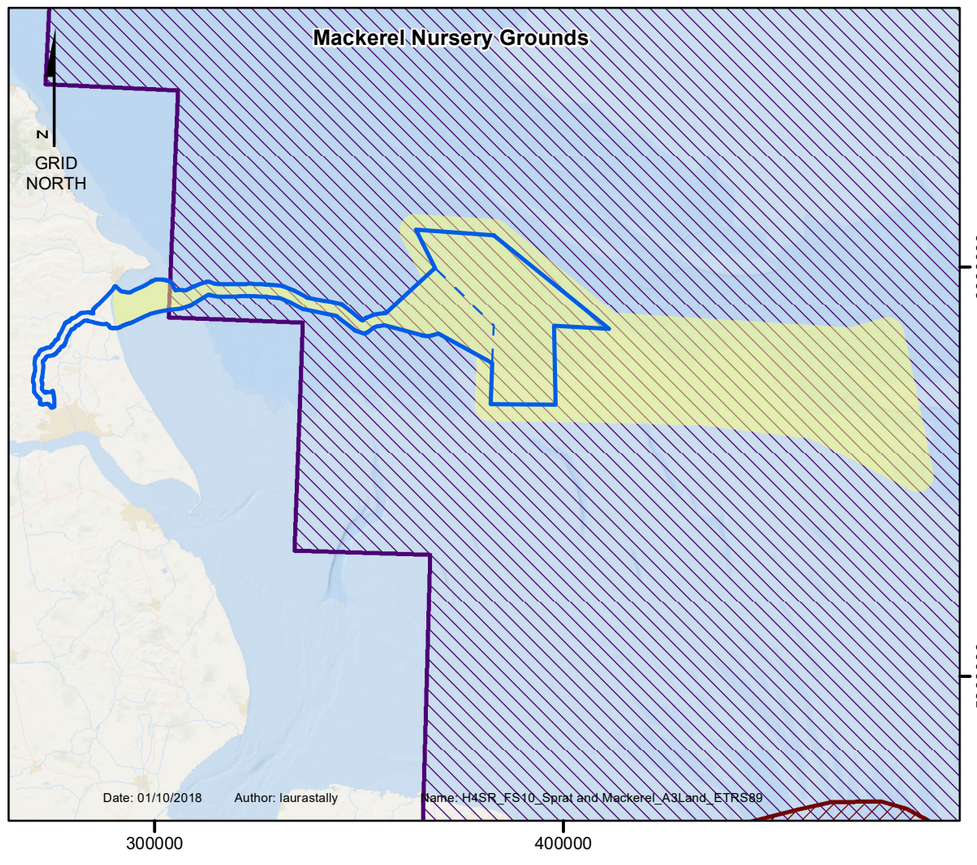
Sprat and Mackerel Spawning and Nursery Areas and Hornsea Trawl Abundance

Figure 6.19









Scoping Boundary

Array Area

Fish and Shellfish Study Area

Spawning / Nursey Grounds (Coull et al., 1998)

- High Intensity
- Low Intensity
- Undetermined Intensity

Otter Trawl Abundance per 500m - Spring

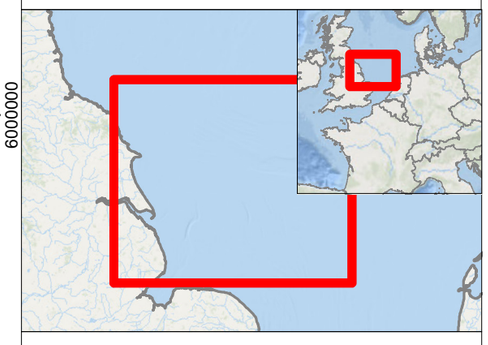
- 0
- 0-50
- 50-100
- 100-250
- 250-500
- 500-1000

Spawning / Nursey Grounds (Ellis et al., 2010)

- High Intensity
- Low Intensity

Otter Trawl Abundance per 500m - Autumn

- 0
- 0.01-50
- 50-100
- 100-250
- 250-500
- 500-1000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:1500000

0 5 10 20 30 40 Kilometres

0 4 8 16 24 Nautical Miles

Sprat and Mackerel Spawning and Nursery Areas and Hornsea Trawl Abundance
Document no: H4SR_FS10
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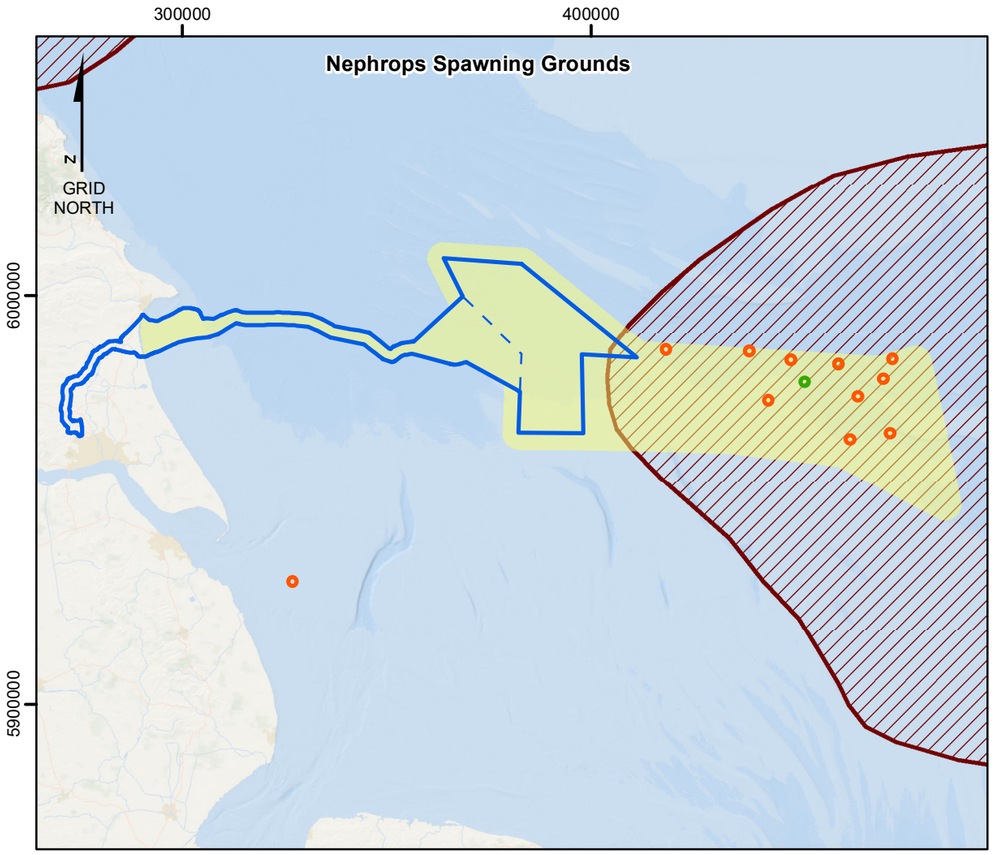
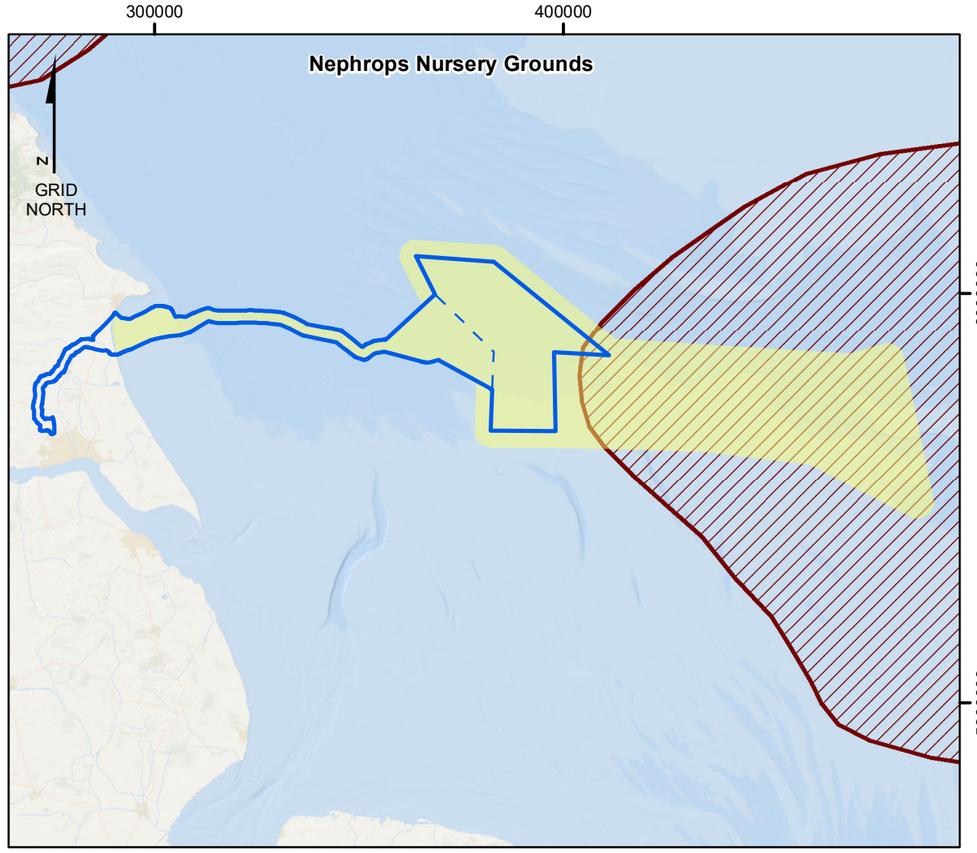
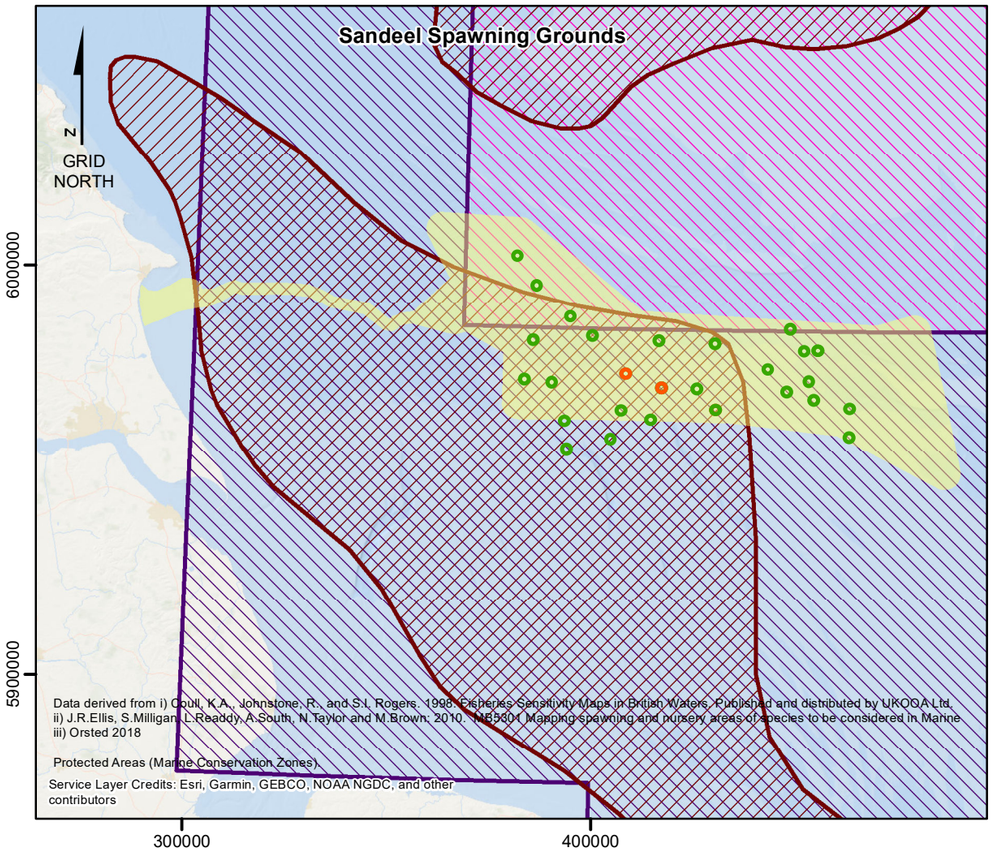
Hornsea Four

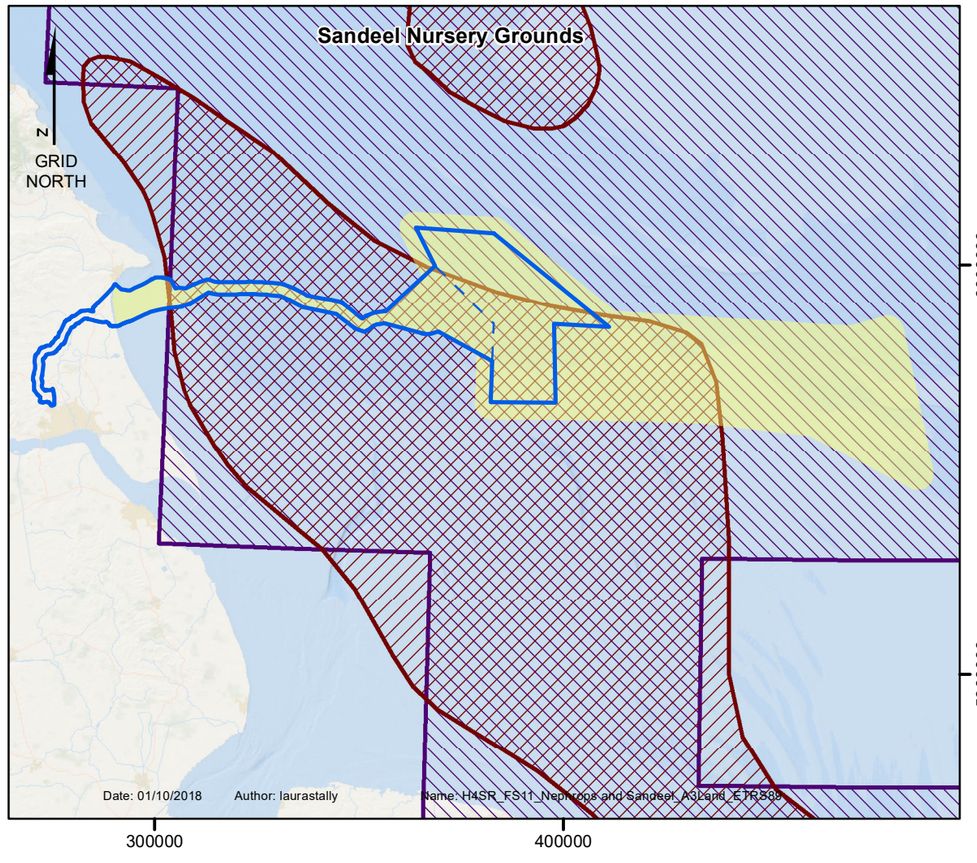
Nephrops and Sandeel Spawning and Nursery Areas and Hornsea Trawl Abundance

Figure 6.20









Scoping Boundary

Array Area

Fish and Shellfish Study Area

Spawning / Nursey Grounds (Coull et al., 1998)

- High Intensity
- Low Intensity
- Undetermined Intensity

Otter Trawl Abundance per 500m - Spring

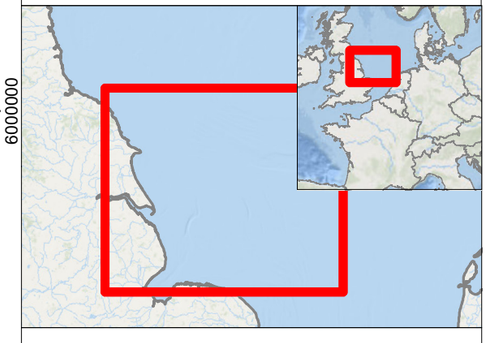
- 0
- 0-50
- 50-100
- 100-250
- 250-500
- 500-1000

Spawning / Nursey Grounds (Ellis et al., 2010)

- High Intensity
- Low Intensity

Otter Trawl Abundance per 500m - Autumn

- 0
- 0.01-50
- 50-100
- 100-250
- 250-500
- 500-1000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:2013000

0 10 20 40 60 80 100 Kilometres

0 3 6 12 18 24 30 Nautical Miles

Nephrops and Sandeel Spawning and Nursery Areas and Hornsea Trawl Abundance
Document no: H4SR_FS11
Created by: RM
Checked by: CC
Approved by: LK

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Table 6-10 - Spawning and nursery areas of fish and shellfish species in the vicinity of the Hornsea Four array area and offshore ECC (data from: Coull *et al*, 1998; Ellis *et al.*, 2012 and Eaton *et al.*, 2003)

Species	Spawning area overlap with the array area or EEC	Nursery area overlap with the array area or EEC
Cod	Low intensity	Low intensity
Whiting	Low intensity	High intensity
Plaice	High intensity	No overlap
Lemon sole	Low intensity	Low intensity
Sprat	Low intensity	Low intensity
Herring	Low intensity (partial)	Low intensity
Mackerel	Low intensity	Low intensity
Sandeel	High intensity (at northern periphery of site) and otherwise low intensity	Low intensity
Nephrops	Partial overlap	Partial overlap
Brown Crab	Partial overlap	None

6.4.3.16 Several species of shellfish, some of which are commercially important, were caught in the otter and epibenthic trawls during the former Hornsea Zone surveys. Shellfish recorded within or in close proximity to the Hornsea Four array area include brown crab (*Cancer pagurus)*, European lobster (*Homarus gammarus)*, whelk (*Buccinum undatum)*, brown shrimp (*Crangon crangon)* and pink shrimp (*Pandalus* sp). Further information on the key shellfish commercial fisheries is presented within **section 6.8** Commercial Fisheries of this Scoping Report.

6.4.3.17 The nearshore areas of the offshore ECC coincide with the inshore area of the Creyke Beck Offshore Wind Farm Export Cable route (Forewind, 2017). Inshore surveys indicated a similar fish and shellfish assemblage to those recorded within the offshore site and typical of the wider region. Trammel net data reported as part of the Creyke Beck ES noted that inshore fish assemblages were dominated by whiting and dab in all surveys. Flounder and mackerel were also common with the lesser spotted dogfish Scyliorhinus canicula present in high numbers at two locations. The potting survey recorded a shellfish assemblage typical of the region with brown crab and velvet swimming crab the most abundant species. Epifaunal communities recorded were dominated by the brown shrimp (*Crangon crangon*) although the remaining catch was typical of the species assemblage recorded using the other gear types.

Summary and Key Issues

6.4.3.18 The key fish and shellfish receptors within the primary and secondary study areas are identified as follows:

- demersal species of whiting, cod, dab, plaice and lemon sole;
- pelagic species of herring, sprat and mackerel;
- sandeel species;
- benthic shellfish species of brown crab, lobster and velvet swimming crab;
- elasmobranch species of lesser spotted dogfish, lesser spotted dogfish, tope, thornback ray, blonde bay, cuckoo ray, spotted ray, starry smooth-hound; and,
- migratory species of Atlantic salmon, trout and European eel.

6.4.4 Project Basis for Scoping Assessment

6.4.4.1 The fish and shellfish scoping assessment is based on the following worst case scenario:

- the construction of up to 180 wind turbine generators (WTGs) on a substructure foundation (varies depending on impact) with associated seabed preparation and scour protection;
- the construction of up to ten offshore substations, platforms, and accommodation platforms within the array area and up to three HVAC booster stations along the offshore ECC, all on gravity base structure foundations with associated seabed preparation and scour protection; and
- the construction of up to six offshore export cables, inter-array cables, up to 13 interconnector cables and associated cable protection.

6.4.5 Embedded Mitigation

6.4.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on environmental receptors. These are presented in **Table 6-11**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

6.4.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section 6.4.6** (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 6-11 – Relevant Fish and Shellfish Ecology Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co83	Primary: Undertake a cable burial risk assessment to inform front-end engineering works. Cable burial will be the preferred option for cable protection.	Secured in the dMLs through the requirement for a CSIP.
Co109	Tertiary: During piling operations, soft starts will be used, with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.	Secured in the dMLs through the requirement for a MMMP.
Co111	Tertiary: A PEMMP (construction and operation phases) and Decommissioning Plan (decommissioning phase) will be produced and followed. The PEMMP and Decommissioning Plan will cover the construction, operation and maintenance, and decommissioning phases of Hornsea Four respectively and will include a MPCP. This MPCP will outline procedures to protect personnel working and to safeguard the marine environment in the event of an accidental pollution event arising from offshore operations relating to Hornsea Four. The MPCP will also outline mitigation measures should an accidental spill occur, address potential contaminant releases and include key emergency contact details (e.g. Environment Agency, Natural England and the MCA.	Secured in the dMLs through the requirement for a PEMMP and Decommissioning Programme.

6.4.6 Likely Significant Effects

6.4.6.1 Table 6-12 sets out an assessment of effects on fish and shellfish ecology at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.4.6.2 The assessment presented in Table 6-12 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 6-11, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for fish and shellfish ecology effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified fish and shellfish ecologists.

6.4.6.3 Table 6-12 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or

detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.4.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 6-12 - Likely Effects - Fish and Shellfish Ecology

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction phase: Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from construction activities.	None	Minor	Low to medium	**No likely significant effect**	**Scoped out**	None
Construction phase: Temporary localised increases in SSC and smothering.	None	Minor	Low	**No likely significant effect**	**Scoped out**	None
Construction phase: Direct and indirect seabed disturbances leading to the release of sediment contaminants.	None	Negligible to low.	Low to medium	**No likely significant effect**	**Scoped out**	None
Construction phase: Mortality, injury, behavioural changes and auditory masking arising from noise and vibration.	Tertiary Co109	Minor	Medium	**Likely significant effect without secondary mitigation** On the basis of potential subsea noise arising from piling activity and the presence of sensitive species (such as herring and sandeels within the Hornsea Four study area.	Scoped In A detailed assessment approach will be adopted, involving the calculation of the area impacted by subsea noise arising from piling activities within the Hornsea Four array area using noise propagation modelling. Noise impact contours will be determined and the impacts on sensitive fish species assessed against standard thresholds.	The baseline will be informed by the zonal characterisation surveys conducted across the former Hornsea Zone and the infill surveys conducted for Hornsea Project One and Hornsea Project Two supplemented by regional datasets.
Construction phase: Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors.	Tertiary Co111	Negligible	Low to medium	**No likely significant effect**	**Scoped Out**	None

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operational phase: Long-term loss of habitat due to the presence of turbine foundations, scour protection and cable protection.	None	Minor	Low	**No likely significant effect**	**Scoped out**	None
Operational phase: Increased hard substrate and structural complexity as a result of the introduction of turbine foundations, scour protection and cable protection.	None	Minor	Low	**No likely significant effect**	**Scoped out**	None
Operational phase: Underwater noise as a result of operational turbines.	None	Negligible	Low to medium	**No likely significant effect**	**Scoped out**	None
Operational phase: EMF effects arising from cables.	Primary Co83	Minor	Low to medium	**No likely significant effect**	**Scoped out**	None
Operational phase: Direct disturbance resulting from maintenance during operation.	None	Minor	Low to medium	**No likely significant effect**	**Scoped out**	None
Operational phase: Indirect disturbance resulting from the accidental release of pollutants.	Tertiary Co111	Negligible	Low to medium	**No likely significant effect**	**Scoped out**	None
Operational phase: Potentially reduced fishing pressure within the Hornsea Four array area and increases fishing pressure outside the array area due to displacement.	None	Minor	Low	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from decommissioning activities.	None	Minor	Low to medium	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: Temporary localised increases in SSC and smothering.	None	Minor	Low	**No likely significant effect**	**Scoped out**	None

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Decommissioning phase: Direct and indirect seabed disturbances leading to the release of sediment contaminants.	None	Negligible to low.	Low to medium	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: Mortality, injury, behavioural changes and auditory masking arising from noise and vibration.	None	Minor	Low to medium	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors.	Tertiary Co111	Negligible	Low to medium	**No likely significant effect**	**Scoped out**	None

6.4.7 Impacts Scoped Out of Assessment

Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from construction activities

6.4.7.1 The impacts associated with direct damage and disturbance from construction activities will be of limited spatial extent, short term in nature and reversible. It will affect a small proportion of the Hornsea Four development area. Adjacent projects have predicted that construction activities would disturb between 3.57% and 5.8% of seabed habitat within the respective development areas; temporary disturbance of the seabed is likely to be of similar magnitude to adjacent projects. Species present that will be subject to disturbance are likely to be mobile and can move away from the construction activities. The habitats that will be disturbed represent a small area of the total distribution of that habitat type in the central southern North Sea based on regional datasets. The magnitude is considered to be minor.

6.4.7.2 Most fish and shellfish receptors in the southern North Sea fish and shellfish study area are deemed to be of low vulnerability, high recoverability and of local to international importance within the southern North Sea fish and shellfish study area. The sensitivity of these receptors is therefore considered to be low.

6.4.7.3 Brown crab, European lobster and *Nephrops* are deemed to be of high vulnerability, medium to high recoverability and of regional importance within the southern North Sea fish and shellfish study area. The sensitivity of these receptors is therefore considered to be medium.

6.4.7.4 Sandeel and herring are deemed to be of high vulnerability, medium recoverability and of regional importance within the southern North Sea fish and shellfish study area. The sensitivity of these receptors is therefore considered to be medium.

6.4.7.5 For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Temporary localised increases in SSC and smothering

6.4.7.6 Coarse sediment materials will settle quickly upon resuspension while finer sediment particles are likely to disperse quickly with little accumulation of fine sediment based on modelling undertaken for adjacent Hornsea projects (Orsted, 2018b). Therefore, the impact of construction operations leading to increases in SSC and associated sediment deposition is predicted to be of local spatial extent, short term duration, intermittent and reversible and of minor magnitude. It is predicted that the impact will affect fish and shellfish receptors indirectly. The species likely to be present within Hornsea Four are considered tolerant of the increased levels of SSC expected from construction activities as these are unlikely to exceed natural variability; the sensitivity is therefore considered to be low. For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Direct and indirect seabed disturbances leading to the release of sediment contaminants

6.4.7.7 Sediment chemistry analysis within the Hornsea Four array area were below levels considered likely to cause significant effects to the fish and shellfish species. It is therefore unlikely that there will be any significant release of contaminants from sediments within

the Hornsea Four array area. Raised levels of contaminants were noted in coastal areas, however, these levels were typical of the wider Humber region. Impacts will be temporary in nature and will return to the current baseline following cessation of construction activities; the magnitude is therefore considered to be negligible to low. Sensitivity of fish and shellfish will range from low to medium. Fish eggs and larvae will be more sensitive to contaminants released from the seabed. Herring and sandeel are considered most sensitive within the Hornsea Four array area and offshore ECC. For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors

6.4.7.8 Accidental release of pollutants will be managed and mitigated through implementation of a PEMMP. Any pollutants would be limited to the inventory present on construction vessels and in the event there was a spill would quickly disperse and weather. The magnitude of any impact is anticipated to be negligible.

6.4.7.9 Sensitivity of fish and shellfish species to pollution vary depending on the species lifecycle and behaviour. Highly mobile far ranging species generally are less sensitivity to pollution. However, less mobile species and eggs and larvae are more likely to have increased sensitivity. Species that generally stay within Hornsea Four and that have the potential to bioaccumulate toxins through trophic dynamics will have increased sensitivity. Sensitivity is considered to be low to medium for species present with Hornsea Four. For all species it is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Justification for scoping out operation impacts

Long-term loss of habitat due to the presence of turbine foundations, scour protection and cable protection.

6.4.7.10 The area affected by installed infrastructure will cover a relatively small proportion of each species natural range. Generally speaking, offshore wind farm projects have a footprint of less than 1% of the total development area of that project. The adjacent Hornsea projects reported, in the respective ES's, that habitat loss would account for between 0.36 – 0.59% of the total development areas (SmartWind, 2013; 2015; Orsted, 2018b). The impact is therefore limited in spatial extent and the magnitude is considered minor. The fish and shellfish species present within Hornsea Four are mobile and there is a ubiquitous distribution of the supporting habitats present both around the Hornsea Four array area and the wider North Sea. Sensitivity of fish and shellfish species is considered to be low. For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Increased hard substrate and structural complexity as a result of the introduction of turbine foundations, scour protection and cable protection.

6.4.7.11 Fish and shellfish have the potential to be attracted to hard substrate and studies at existing offshore wind farms to date have tended to indicate a redistribution of individuals towards turbine foundations for certain species (Andersson, 2011). In some cases, a shift from a species assemblage typical of soft bottom habitats to an assemblage more

commonly observed around hard substrates has been observed. Studies to date have shown no broader changes to fish populations on introduction of hard substrate (Leonhard et al. (Danish Energy Agency, 2012). Post-construction fisheries surveys conducted in line with the Food and Environment Protection Act (FEPA) licence requirements for the Barrow and North Hoyle OWFs, found no evidence of fish abundance across these sites being affected, either positively or negatively, by the presence of the OWFs (Cefas, 2009; BOWind, 2008) therefore suggesting that any effects, if seen, are likely to be highly localised. Shellfish are more likely to use the area as an area of refuge from predation and some colonising species such as blue mussel may be able to extend its natural range around foundations and scour protection. The additional hard substrate will be of limited spatial extent relative to the distribution of sedimentary habitats in the area, although it is acknowledged that this impact will persist for the duration of the project lifecycle; the magnitude is considered to be minor. Fish and shellfish receptors in the primary and secondary study areas are deemed to be of low vulnerability and local to international importance (recoverability is not relevant to this impact) and the sensitivity is therefore assigned as low. For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Underwater noise as a result of operational turbines.

6.4.7.12 Studies have shown noise from operating turbines to be detectable only in close proximity to the turbine locations (Wahlberg and Westerberg, 2005). The spatial extent is considered to be limited to the immediate proximity of the turbine foundations. Noise levels will not be sufficient to result in injury and would be restricted to local behavioural responses. The magnitude of this impact is considered to be negligible.

6.4.7.13 Determination of sensitivity has been informed by Popper et al (2014) which groups fish into four groups based on the hearing anatomy of each species. Sensitive species are considered to be those with specialist hearing adaptions such as herring and sprat, and those with more general hearing adaptions such as cod and eel which may also use the particle motion component of noise. Both these species are considered to be of medium sensitivity. Species considered to be hearing generalists such as salmon, flat fish and elasmobranchs are considered to be of low sensitivity.

6.4.7.14 For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Electromagnetic fields (EMF) effects arising from cables.

6.4.7.15 Underwater cabling has the capacity to produce EMFs that are detectable above natural background levels. Studies have shown that EMFs decrease rapidly with distance from the cable and are likely only to be detectable within circa 10 m (Normandeau et al., 2011). The spatial extent of EMFs will be limited to the immediate vicinity of the cable and the magnitude is considered to be minor. Recent research reported that the effects of EMF at 50Hz (like those emitted from alternating current (AC) cables) result in no unusual behaviour being observed in Atlantic salmon (both adult and smolt stages) (Armstrong et al, 2015). Similar studies undertaken on European eel (Orpwood et al., 2015) also found no changes in behaviour when silver eels were exposed to AC cable EMF.

6.4.7.16 Species of fish and shellfish known to use EMFs for prey detection or navigation are crustaceans, elasmobranchs and migratory fish. Based on the limited research for each species the sensitivity varies by species.

6.4.7.17 Elasmobranch species are deemed to be of medium vulnerability and local importance and are considered to have low sensitivity. Migratory fish species are deemed to be of medium vulnerability and regional to international importance and are considered to have low to medium sensitivity, although effects for these species will be largely limited to coastal areas close to the offshore ECC landfall. All other fish and shellfish receptors are deemed to be of low vulnerability and are of local to regional importance, so the sensitivity is considered to be low. For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Direct disturbance resulting from maintenance during operation.

6.4.7.18 Disturbance from operation and maintenance activities will be of limited spatial extent and will be intermittent and short term in duration. Therefore, the magnitude is considered to be low. As detailed above sensitivity of species present within the Hornsea Four array area and offshore ECC varies from low to medium. For all species it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Indirect disturbance resulting from the accidental release of pollutants.

6.4.7.19 Similar to the construction phase of the project the risk of accidental spills will be managed through implementation of a PEMMP with appropriate control measures and good housekeeping. Similarly, the magnitude of this impact is therefore considered to be negligible. Sensitivity of fish and shellfish will range from low to medium. For all species, it is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Potentially reduced fishing pressure within the Hornsea Project 4 array area and increases fishing pressure outside the array area due to displacement.

6.4.7.20 Advisory safety zones may be in place around turbine foundations. These could vary between 50m and 500m depending on whether there is work vessels in place. Due to the limited spatial extent the magnitude is considered to be minor. A number of commercially targeted species have been recorded in the Hornsea Four array area including: plaice, sole, cod, whiting, herring, *Nephrops*, brown crab and lobster. Any reduced fishing pressure may result in positive effects to these species. They are deemed to be low vulnerability and high recoverability to this impact and of local to international importance. For all species, it is considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Justification for scoping out decommissioning impacts

Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from decommissioning activities.

6.4.7.21 The assessment of this impact will be synonymous with the assessment presented under the construction phase assessment above. As such it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Temporary localised increases in SSC and smothering.

6.4.7.22 The assessment of this impact will be synonymous with the assessment presented under the construction phase assessment above. As such it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Direct and indirect seabed disturbances leading to the release of sediment contaminants.

The assessment of this impact will be synonymous with the assessment presented under the construction phase assessment above. As such it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Mortality, injury, behavioural changes and auditory masking arising from noise and vibration.

6.4.7.23 Noise generated during decommissioning is anticipated to be greater than during the operational phase of the development. The impacts will be short term in duration and intermittent, and the spatial extent will be limited to the local area. The magnitude is considered to be minor. Sensitivity of species will vary from low to medium. For all species, it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors

6.4.7.24 The assessment of this impact will be synonymous with the assessment presented under the construction phase assessment above. As such it considered that there is no risk of likely significant effect and it is proposed that this impact be scoped out of the EIA.

6.4.8 Proposed Approach to the PEIR and ES

6.4.8.1 The EIA will assess the potential impacts from noise arising from Hornsea Four on species identified during ZoC, Hornsea One and Two surveys and from the desk-based review. The approach to EIA will follow the general approach outlined in Chapter 5 EIA Methodology of this Scoping Report.

6.4.8.2 In addition to the general approach and guidance outlined in Chapter 5 EIA Methodology, the assessment of fish and shellfish receptors will also comply with the following guidance documents where they are specific to this topic:

- Guidelines for EcIA in Britain and Ireland. Marine and Coastal, Final Document (IEEM, 2010);

- Offshore Wind Farms. Guidance note for EIA in respect of FEPA and CPA requirements (Cefas et al., 2004);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Judd, 2012); and
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).

6.4.8.3 Species sensitivities will be derived based on the importance of the Hornsea Four array area and offshore ECC to specific periods of vulnerability within a species life history taking account of the following:

- spawning grounds;
- nursery grounds;
- feeding grounds; and,
- migration routes.

6.4.8.4 The sensitivity to each species will also consider the hearing sensitivity of each species as reported by Popper et al (2014). Fish will be assigned to one of four categories depending on the species hearing ability. An assessment will then be made taking into consideration potential injury and disturbance of each species and based on the outputs of the detailed noise modelling.

6.4.9 Scoping Questions for Consultees

6.4.9.1 Scoping questions for consultees in relation to fish and shellfish ecology include:

1. Are you satisfied that the baseline data referenced above is valid for the purposes of the scoping assessment?
2. Do you agree, considering the embedded mitigation in place, that the assessment of Fish and Shellfish impacts as detailed above, and with the exception of impacts resulting from percussive piling, should be scoped out of the Hornsea Four EIA for the forthcoming Application?
3. Do you agree with the proposed approach to the assessment of noise impacts, including the use of the Popper et al (2014) sensitivities?
4. Do you agree that the cumulative effects on Fish and Shellfish receptors (other than those related to subsea noise effects during construction) should be scoped out of the EIA for Hornsea Four based on the assumptions detailed in this Scoping Report?

6.5 Marine Mammals

6.5.1 Introduction

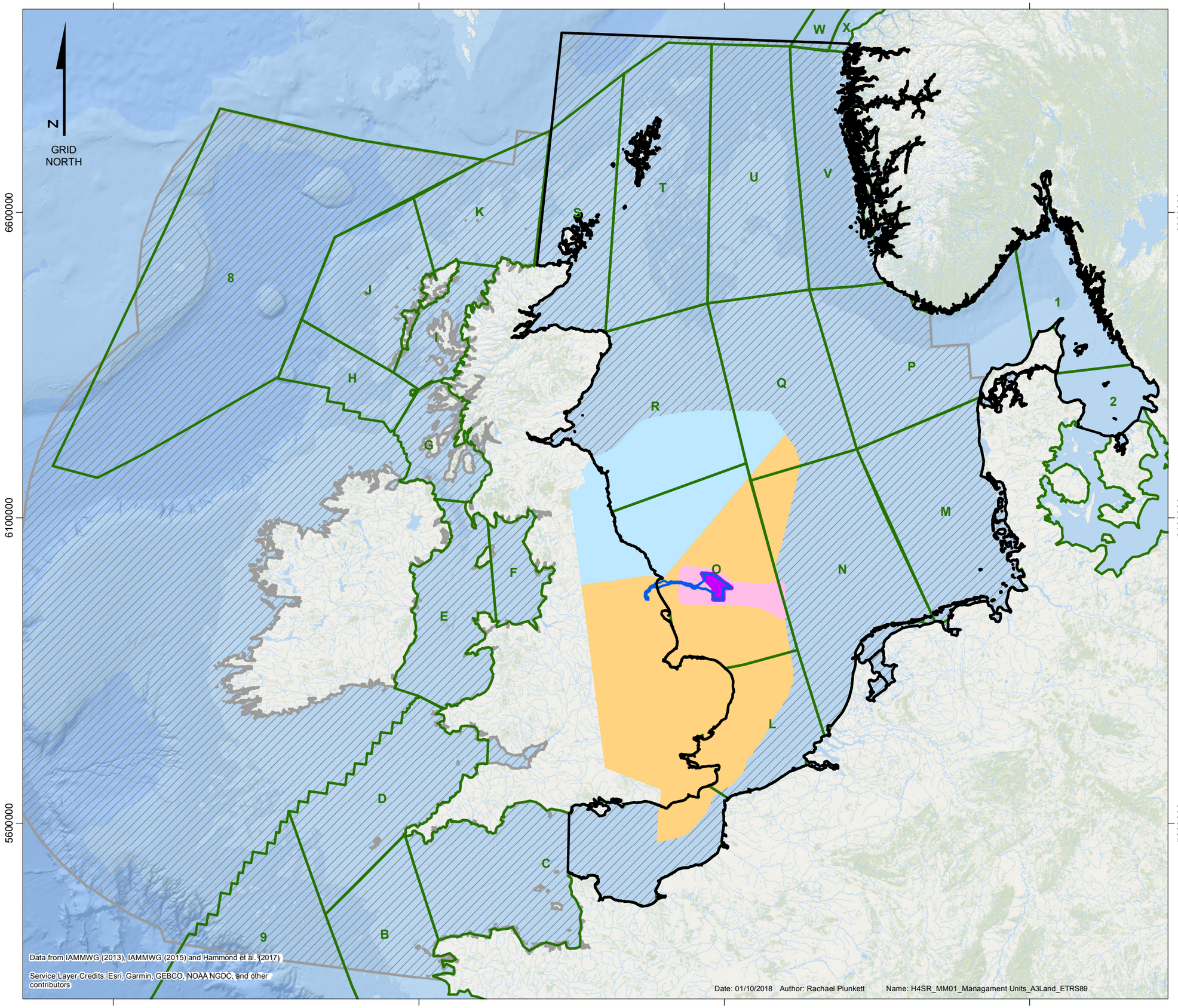
6.5.1.1 This section of the Scoping Report identifies the marine mammal receptors of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components (i.e. seaward of MHWS) of Hornsea Four on marine mammals.

6.5.1.2 The identification of marine mammal species present in the Hornsea Four area were mainly informed by the 24 HiDef aerial surveys of the Hornsea Four array area plus 4 km buffer conducted monthly between April 2016 and March 2018, visual and acoustic surveys of the former Hornsea Zone plus 10 km buffer, the SCANS III data, seal usage maps and seal telemetry data. The following species of marine mammals have been identified as the only five marine mammal species expected to be present in the Hornsea Four array area: harbour porpoise (*Phocoena phocoena*), white-beaked dolphins (*Lagenorhynchus albirostris*), minke whales (*Balaenoptera acutorostrata*), harbour seals *(Phoca vitulina)* and grey seals (*Halichoerus grypus*). Therefore, the marine mammal assessment for Hornsea Four will be based on these five species.

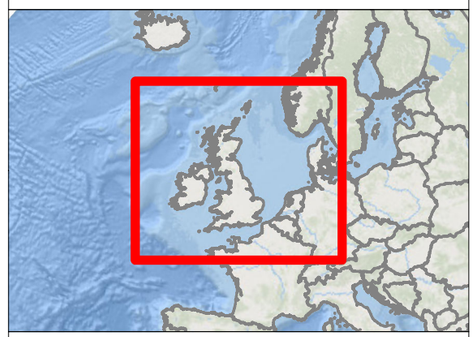
6.5.2 Study Area

6.5.2.1 The study area for marine mammals has been defined at two spatial scales: the Management Unit (MU) scale for species specific population units and the marine mammal survey areas for an indication of the local densities of each species (**Figure 6-21**). Hornsea Four is located within the ICES North Sea Assessment Unit for harbour porpoise (ICES, 2014), the Celtic and Greater North Seas MU (MU) for white-beaked dolphins and minke whales (IAMMWG, 2015) and the South East England Seal Management Area (SMA) for both grey and harbour seals (SCOS, 2017). The marine mammal survey area encompasses the Hornsea Four array area plus 4 km buffer and the offshore ECC and also extends out to incorporate the former Hornsea Zone plus 10 km buffer area, in order to provide more temporal and spatial fine scale local data.

Hornsea Four
Marine Mammal Study Areas
Figure 6.21



- Scoping Boundary
- North Sea Management Unit
- SCANS-III survey blocks
- Hornsea Four Array Area plus 4 km buffer
- Former Hornsea Zone plus 10 km buffer
- Northeast England Seal Management Area
- Southeast England Seal Management Area
- Celtic and Greater North Seas Management Unit



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:6000000

0 40 80 160 240 320 Kilometres

0 25 50 100 150 Nautical Miles

Marine Mammal Study Areas
Document no: H4SR_MM01
Created by: RP
Checked by: CES
Approved by: CES

SMRU Consulting Europe

Ørsted

6.5.3 Baseline Environment

Data Sources used for Scoping

6.5.3.1 An initial desk-based review of literature and existing data sources was undertaken to support this Scoping Report. The data sources are summarised in **Table 6-13** and provide details of the coverage of the Hornsea Four array area and offshore ECC.

Table 6-13 - Key sources of Marine Mammal Data

Source	Summary	Coverage of Hornsea Four array area and offshore ECC
Hornsea Four aerial surveys	HiDef Digital Aerial Surveying Ltd. conducted monthly surveys between April 2016 and March 2018.	Full coverage of the Hornsea Four array area plus 4 km buffer.
Former Hornsea Zone surveys	Monthly boat-based visual and towed acoustic surveys conducted between March 2010 and February 2013.	Coverage of the former Hornsea Zone plus 10 km buffer which included the Hornsea Four array area.
SCANS III	Hornsea Four is located in SCANS III survey block O which was surveyed by visual aerial survey in July 2017.	Broadscale cetacean data with a uniform density estimate for the block containing the Hornsea Four array area and offshore ECC.
SMRU August haul-out counts	August haul-out surveys of harbour and grey seals (SCOS, 2017).	Broadscale data with coverage of the coastline near the offshore ECC landfall.
SMRU grey seal pup counts	Surveys of the main UK grey seal breeding colonies annually between mid-September and late-November to estimate the numbers of pups born at the main breeding colonies (SCOS, 2017).	Broadscale data with coverage of the coastline near the Hornsea Four offshore ECC landfall.
SMRU seal telemetry data	86 harbour seals tagged in the Southeast England Seal Management Area (SMA) between 2003 and 2016 at the Wash and the Thames. 70 grey seals tagged in the Southeast and Northeast England SMAs between 1988 and 2015 at Donna Nook, Blakeney and the Farnes.	Broadscale data with telemetry tracks within the Hornsea Four array area and offshore ECC.
Seal at-sea usage maps	Telemetry data from 270 grey seals and 330 harbour seals tagged in the UK were combined with haul-out count data between 1996 and 2015 to provide estimates of at-sea usage for each species (the mean number of grey or harbour seals estimated in be in the water in each grid cell at any given time) (Russell et al., 2017).	Broadscale data with estimated densities within the Hornsea Four array area and offshore ECC.
JNCC Report 544	Analysis of 18 years of survey data on harbour porpoise between 1994 and 2011 held in the JCP database to identify "discrete and persistent areas of high density" that might be considered important for harbour porpoise (Heinänen and Skov, 2015).	Broadscale data with estimated densities within the Hornsea Four array area and offshore ECC.

6.5.3.2 A full analysis of the former Hornsea zone specific survey data is presented in the Hornsea Project Three Offshore Wind Farm Marine Mammal Technical Report. The technical report presents an analysis of all data collected across the zone including the Hornsea Four array

area and therefore has provided a useful description of the baseline information relevant to the Hornsea Four scoping exercise.

6.5.3.3 While the following data sources are not currently available at the time of scoping, they are expected to be available for inclusion in the ES chapter:

- SCANS III spatially explicit modelled density surfaces for harbour porpoise, minke whales and white-beaked dolphins (expected early 2019);
- SMRU August seal haul-out counts from 2017 for both harbour and grey seals (expected in SCOS, 2018); and
- SMRU grey seal pup production estimates from 2016 grey seal breeding surveys (expected in SCOS 2018).

Overview of Baseline Environment

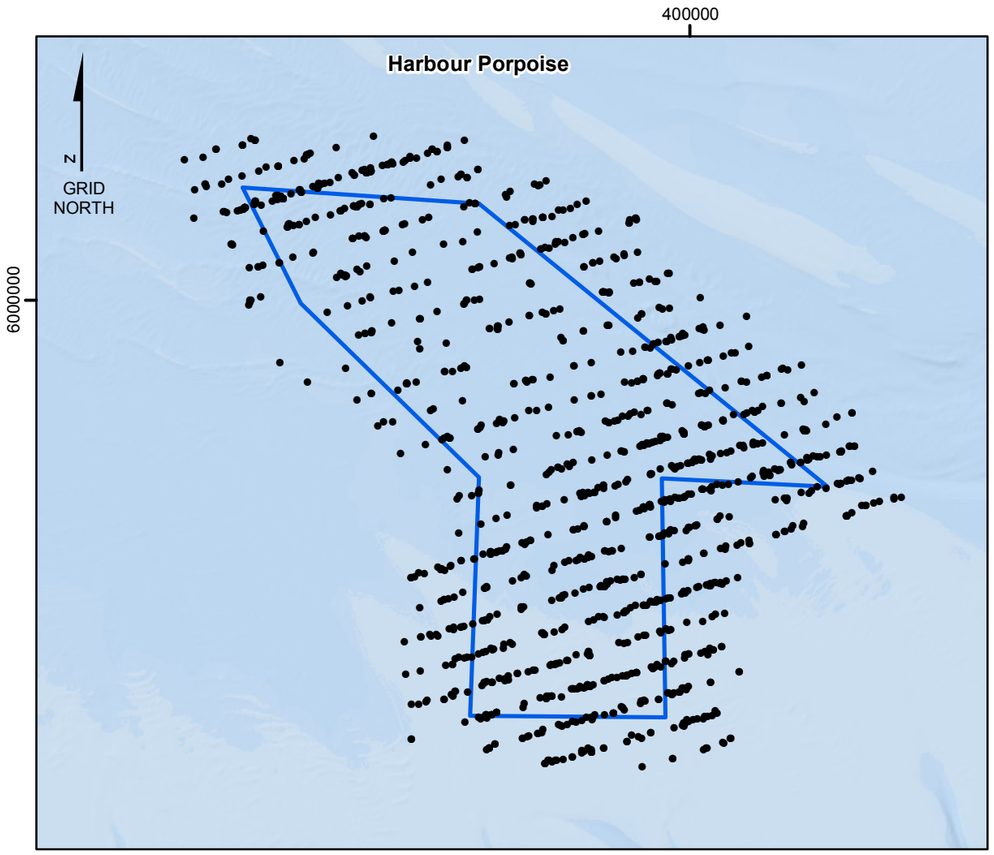
6.5.3.4 Table 6-14 gives a summary of the estimated MU sizes and density estimates available for the five marine mammal receptors.

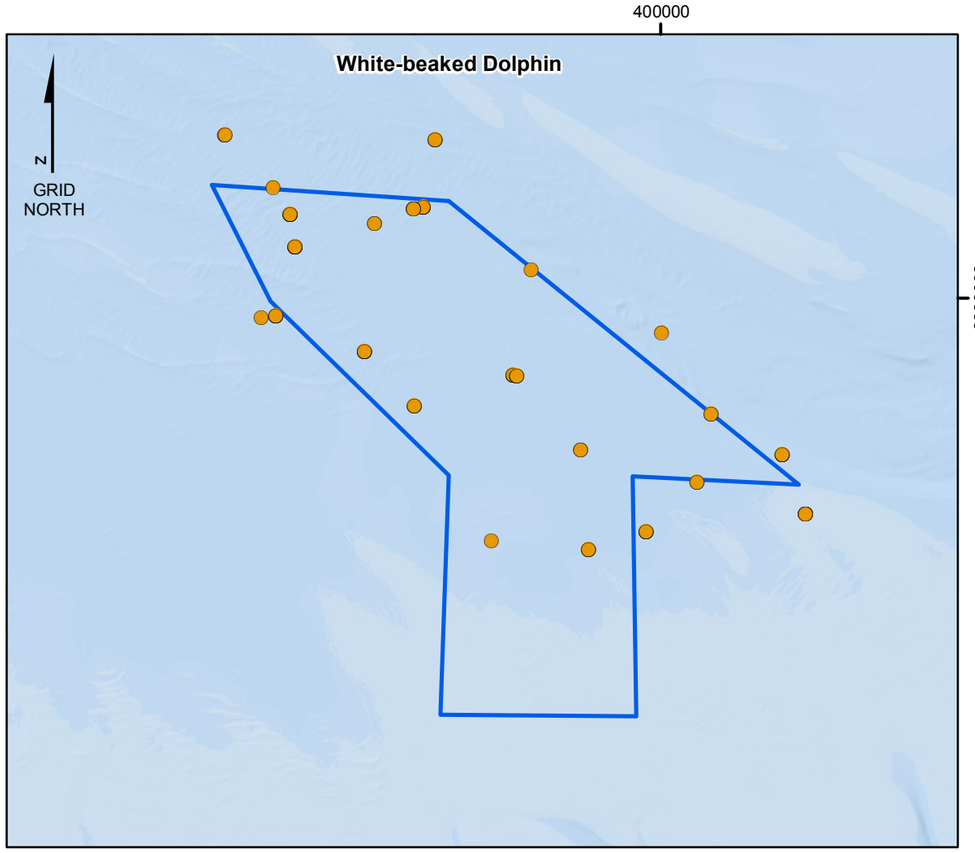
Table 6-14 - Summary MU and density estimates available for each marine mammal species. The appropriate MU definition for each species is given in the text.

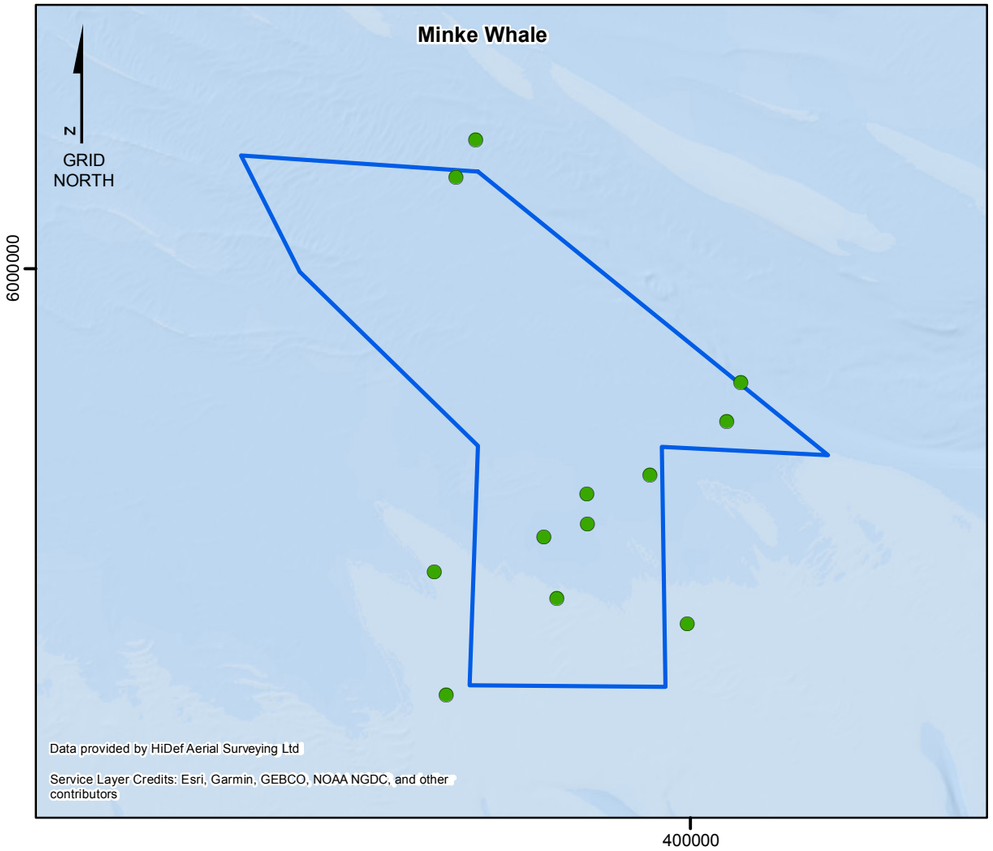
Species	MU Size	Density Estimates
Harbour porpoise	345,373 (SCANS III)	**HiDef aerial surveys**: 1,327 sightings of individuals. Highest sightings between June and October. Occurred throughout the survey area, with more sightings in the south of the array area (Figure 6-22). **Former Hornsea Zone visual surveys**: Gradient in density within the array area with up to 5.4 porpoise/km2 at the south and lower densities in the north (Figure 6-23). **Former Hornsea Zone acoustic surveys: up to 3.9 porpoise/km2 at the south of the array area with lower densities in the north (Figure 6-23).** **SCANS III**: 0.888 porpoise/km2 in block O. **Heinänen and Skov**: >3 porpoise/km2 within the array area.
White-beaked dolphin	36,287 (SCANS III)	**HiDef aerial surveys:** 82 sightings of individuals mostly between June and October. Mostly in the northern half of the array area (Figure 6-22). **Former Hornsea Zone visual surveys:** Gradient in density within the array area with up to 0.04 dolphins/km2 in the northwest and lower densities in the south (Figure 6-23). **SCANS III:**0.002 dolphins/km^2 in block O.
Minke whale	14,759 (SCANS III)	**HiDef aerial surveys:** 12 sightings of individuals and only between June and August. Mostly in the southern half of the array area (Figure 6-22). **Former Hornsea Zone visual surveys: Gradient in density within the array area with up to** 0.013 whales/km2 in the northwest and lower densities in the south (Figure 6-23**).** **SCANS III:**0.010 whales/km^2 in block O.
Harbour seal	7,029 (scaled 2016 August haul-out counts)	**HiDef aerial surveys:** 1 individual sighted plus 58 "unknown seal species" (Figure 6-22). **At-sea usage map** (Figure 6-24): • Up to 0.28 seals/km^2 within array area

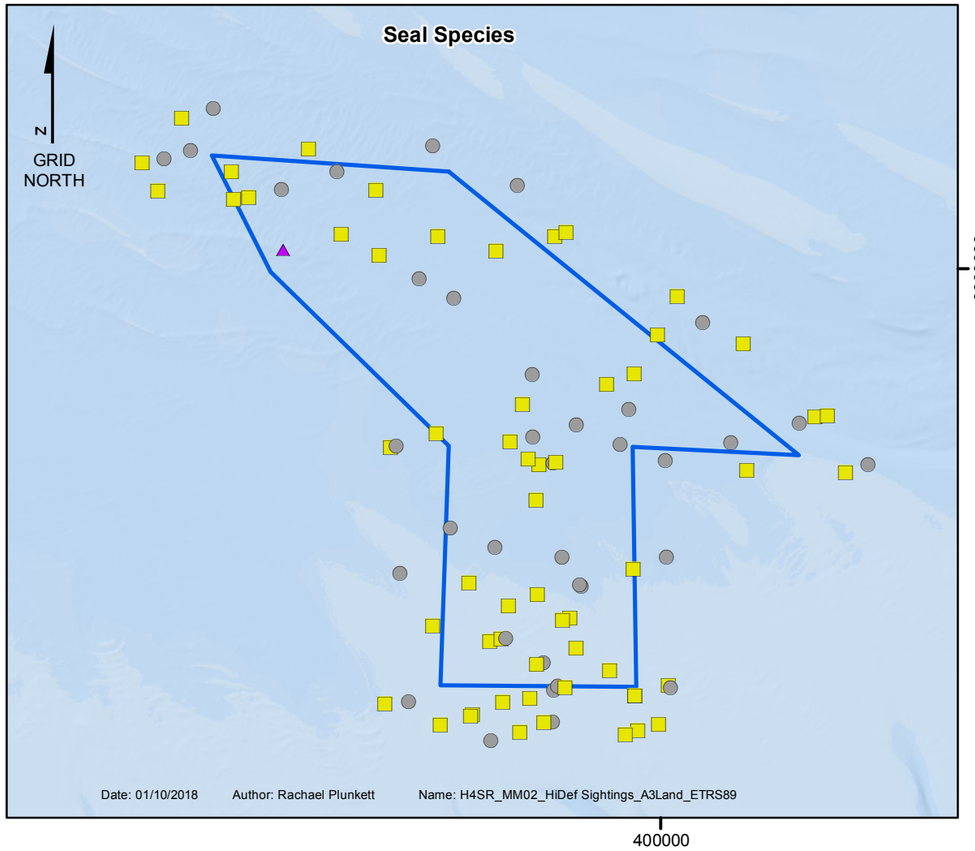
Species	MU Size	Density Estimates
		• Average across array area of 0.04 seals/km^2 • Average across the ECC of 0.005 seals/km^2 **August haul-out counts:** no haul-outs in vicinity of landfall, closest is Donna Nook ~60km south (Figure 6-24). **Telemetry data:** Small amount of overlap with array area. Connectivity with the Wash SAC (Figure 6-24). **EU sites:** Movement between haul-out sites on the European North Sea coast and UK haul-out sites.
Grey seal	34,800 (North Sea modelled pup counts) 15,445 (scaled pup counts from Donnaa Nook, East Anglia & Farnes) 39,494 (scaled 2016 August haul-out counts – NE and SE SMAs combined)	**HiDef aerial surveys:** 38 individuals sighted plus 58 "unknown seal species" (Figure 6-22). **At-sea usage map** (Figure 6-25): • Up to 0.5 seals/km^2 within array area • Average across array area of 0.136 seals/km^2 • Average across the ECC of 0.363 seals/km^2 **August haul-out counts:** no haul-outs in immediate vicinity of landfall, closest is ~21 km away (Figure 6-25). **Telemetry data:** Small amount of overlap with array area. Connectivity between the array area and the Humber Estuary SAC and the Berwickshire and North Northumberland Coast SAC (Figure 6-25). **EU sites:** Movement between haul out sites on the European North Sea coast and UK haul-out sites.

Hornsea Four
HiDef Aerial Sightings
Figure 6.22





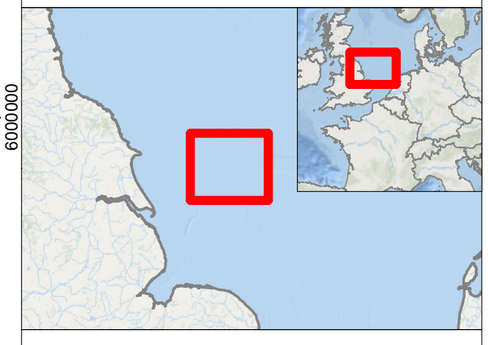




Hornsea Four Array Area

Species

- Harbour porpoise
- White-beaked dolphin
- Minke whale
- Grey seal
- Harbour seal
- Seal species



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:573000

0 2.75 5.5 11 16.5 22 27.5 Kilometres

0 2.5 5 10 15 20 25

HiDef Aerial Sightings
Document no: H4SR_MM02
Created by: RP
Checked by: CES
Approved by: CES

SMRU Consulting Europe

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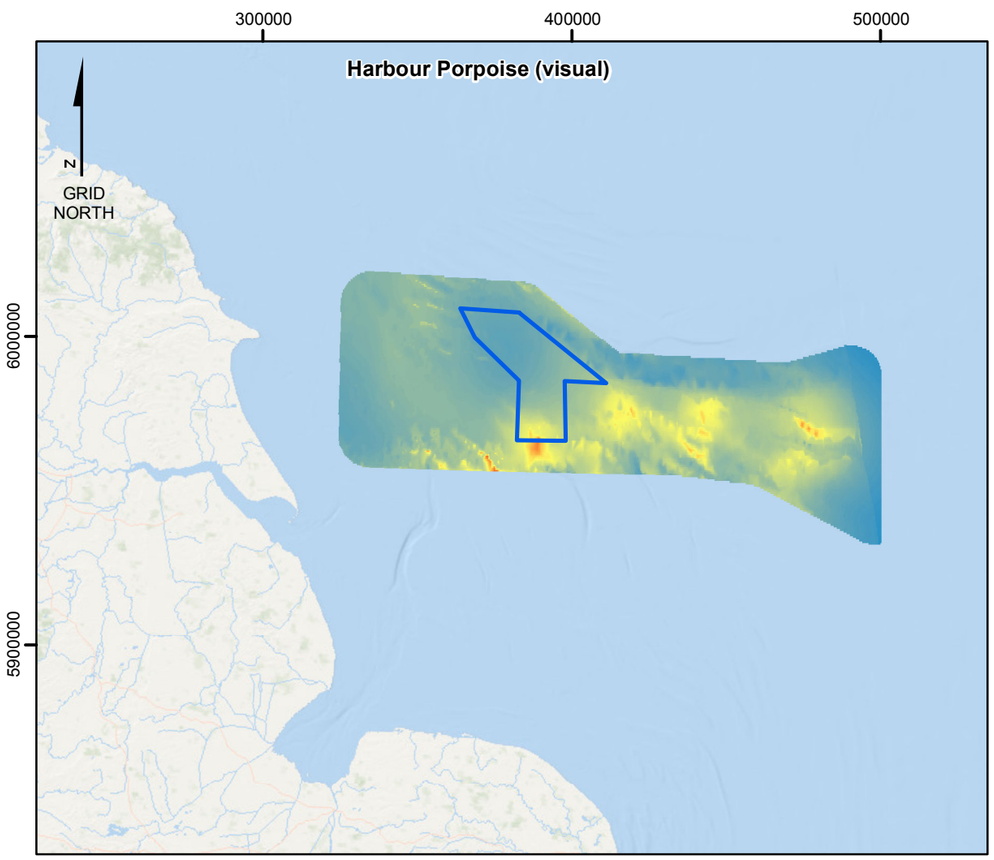
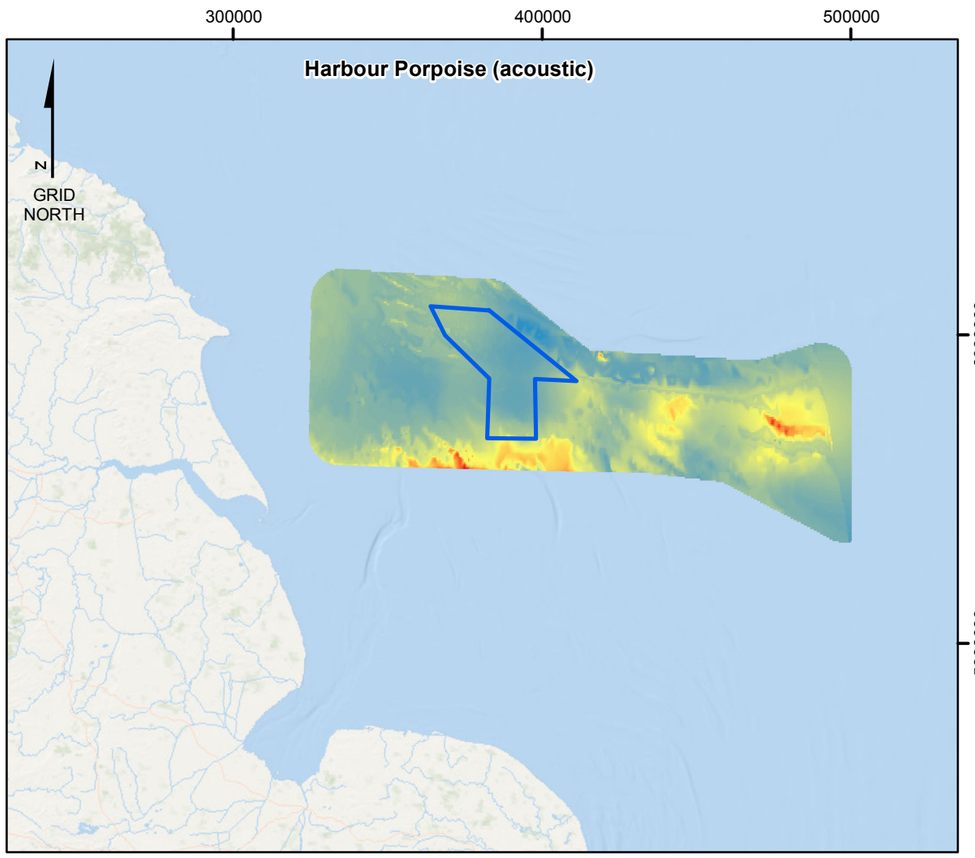
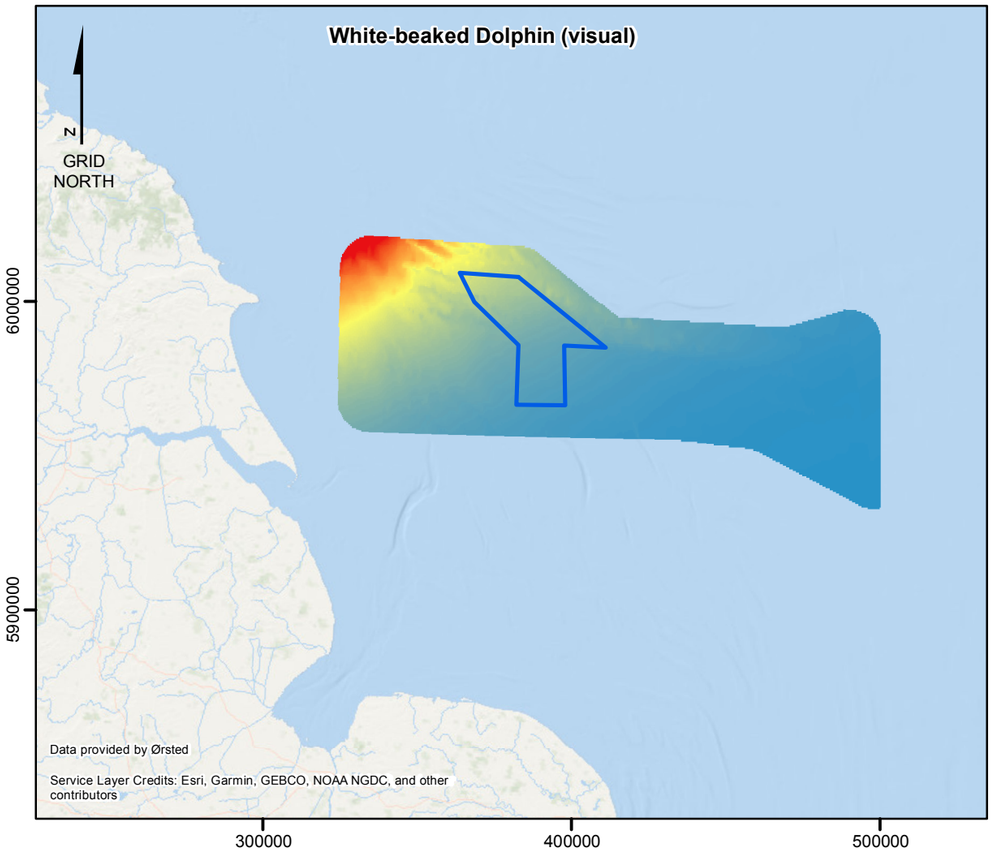
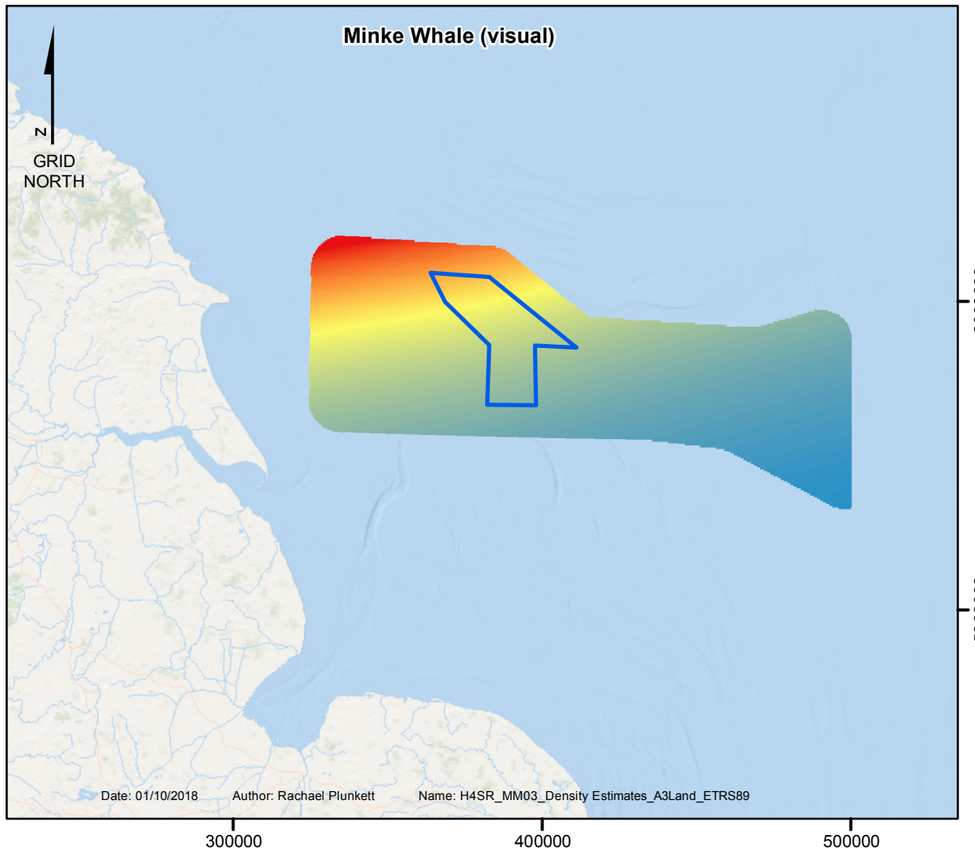
Hornsea Four
Hornsea Zone Density Estimates
Figure 6.23









Hornsea Four Array Area

Harbour Porpoise Density (visual) (#/km²)

High : 6.91733

Low : 0.281666

Harbour Porpoise Density (acoustic) (#/km²)

High : 6.91733

Low : 0.627502

White-beaked Dolphin Density (#/km²)

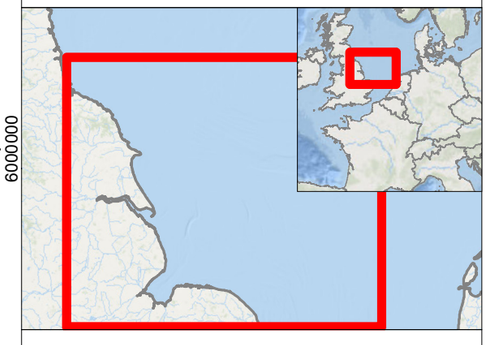
0.12

0

Minke Whale Density (#/km²)

0.02

0



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:2013000

0 10 20 40 60 80 100 Kilometres

0 5 10 20 30 40 50 Nautical Miles

Hornsea Zone Density Estimates
Document no: H4SR_MM03
Created by: RP
Checked by: CES
Approved by: CES

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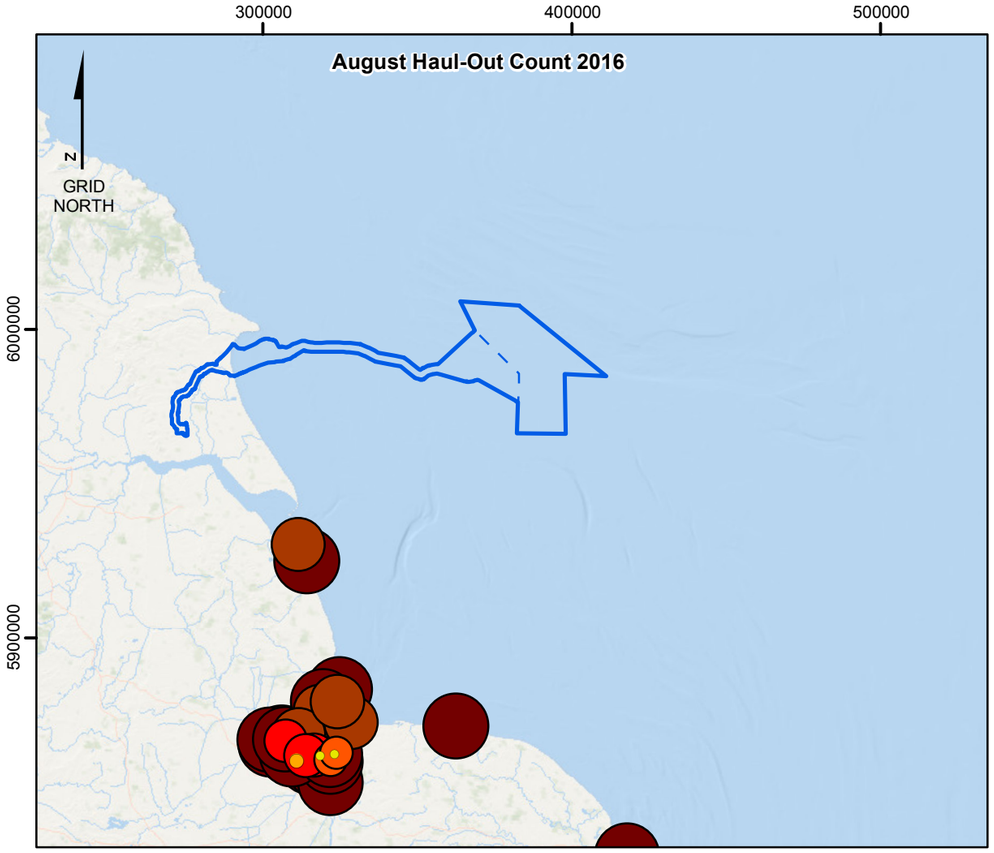
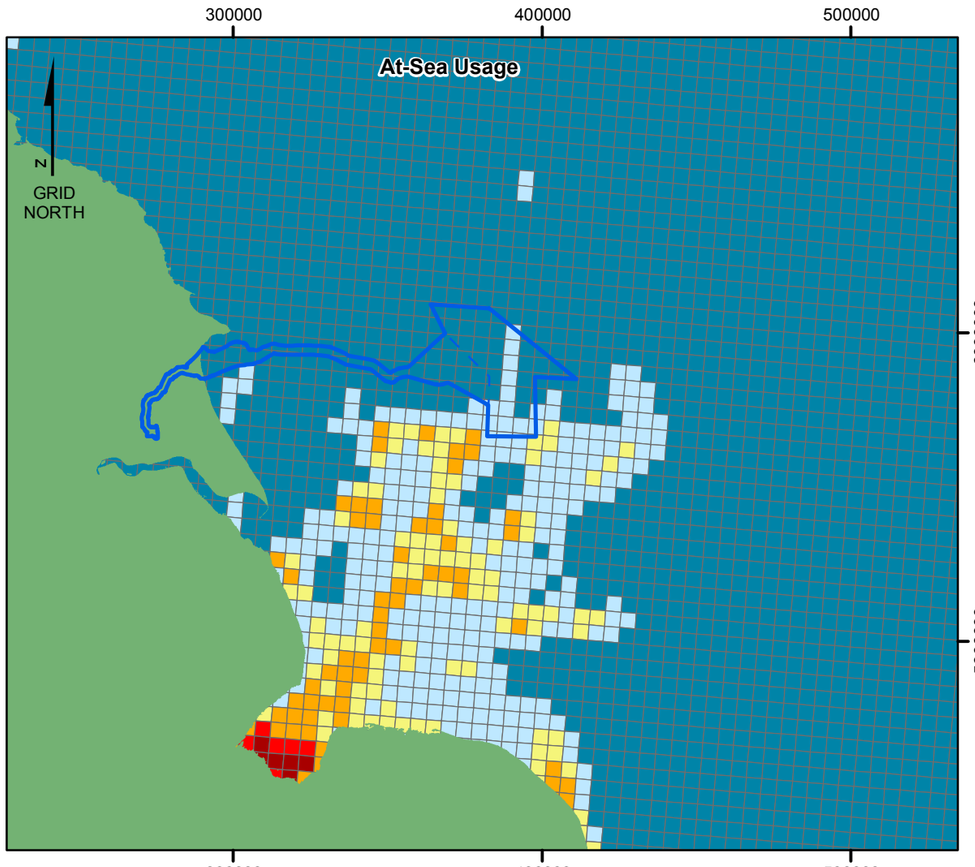
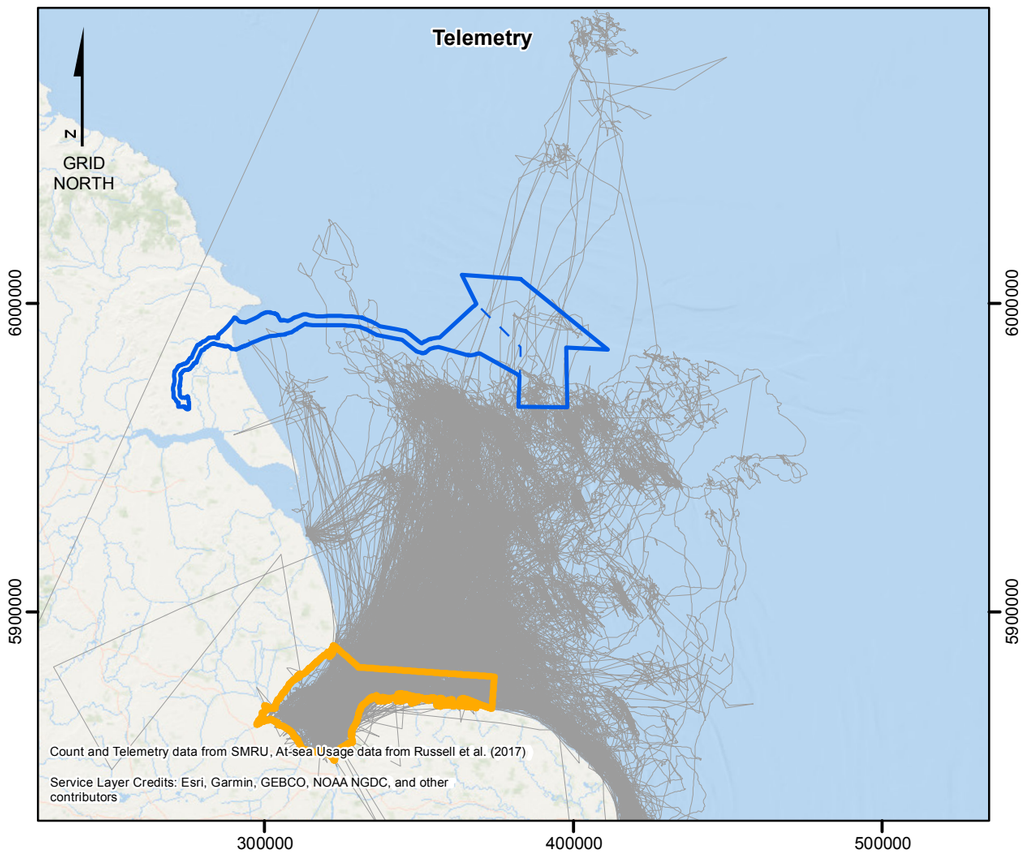
Hornsea Four
Harbour Seal Data
Figure 6.24







Scoping Boundary

Array Area

The Wash Special Area of Conservation

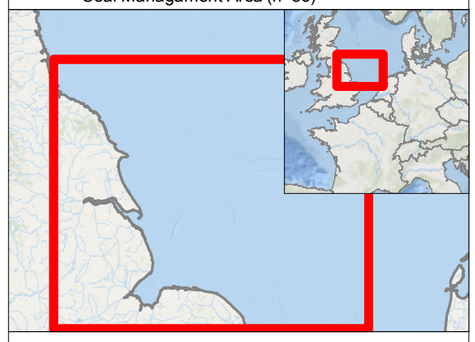
Harbour Seal August Haul-Out Count 2016

- 1-5
- 6-10
- 11-15
- 16-50
- 51-100
- >100

Harbour Seal At-Sea Usage (#/cell)

- 0<1
- 1<5
- 5<10
- 10<50
- 50<100
- >100

Harbour Seals Tagged in the Southeast England Seal Managament Area (n=86)



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:2013000

0 10 20 40 60 80 100 Kilometres

0 5 10 20 30 40 50 Nautical Miles

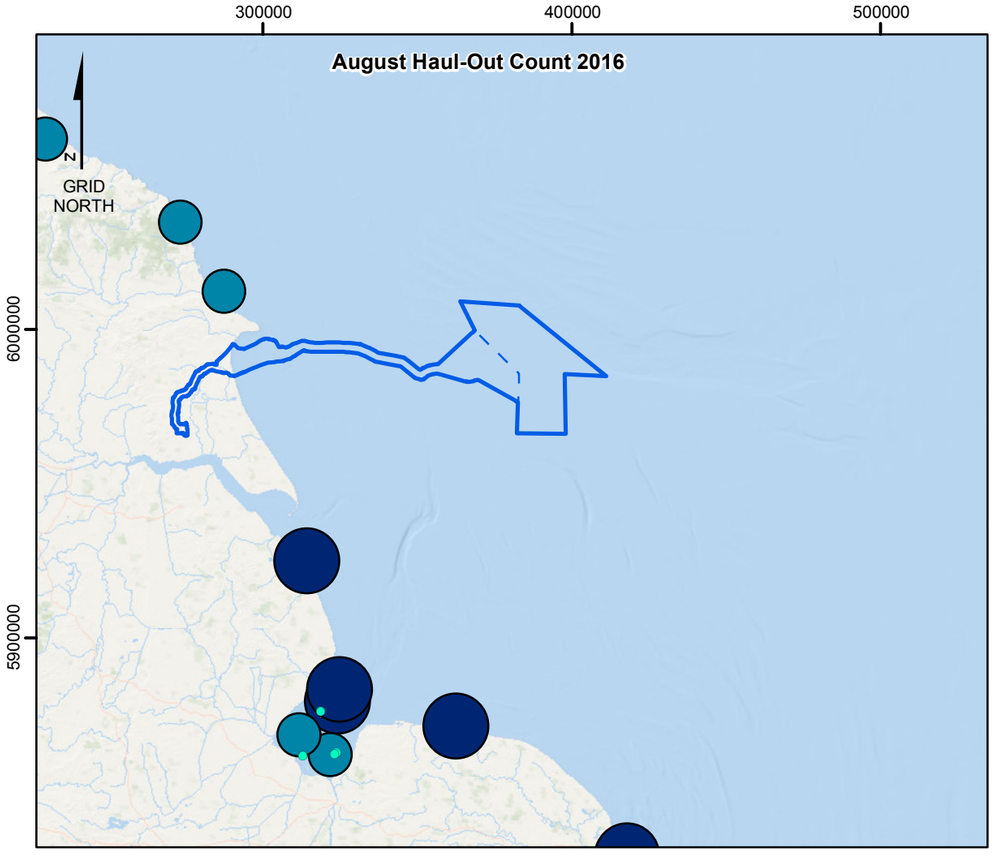
Harbour Seal Data
Document no: H4SR_MM04
Created by: RP
Checked by: CES
Approved by: CES

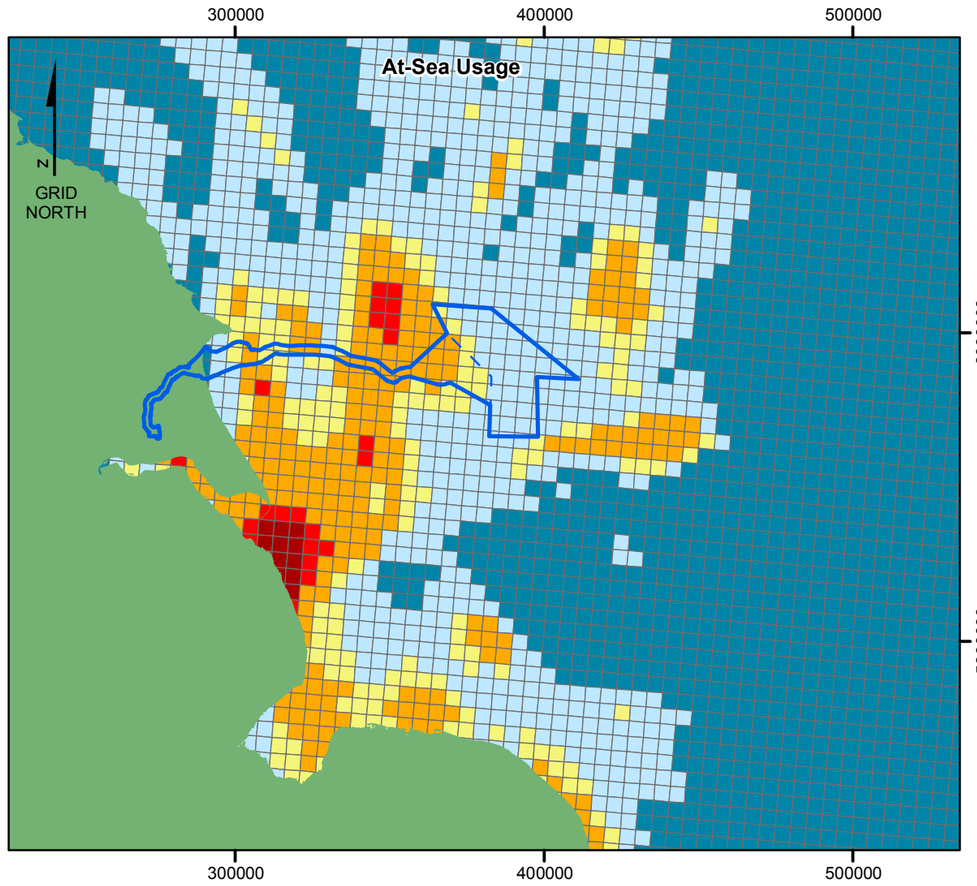
SMRU Consulting Europe

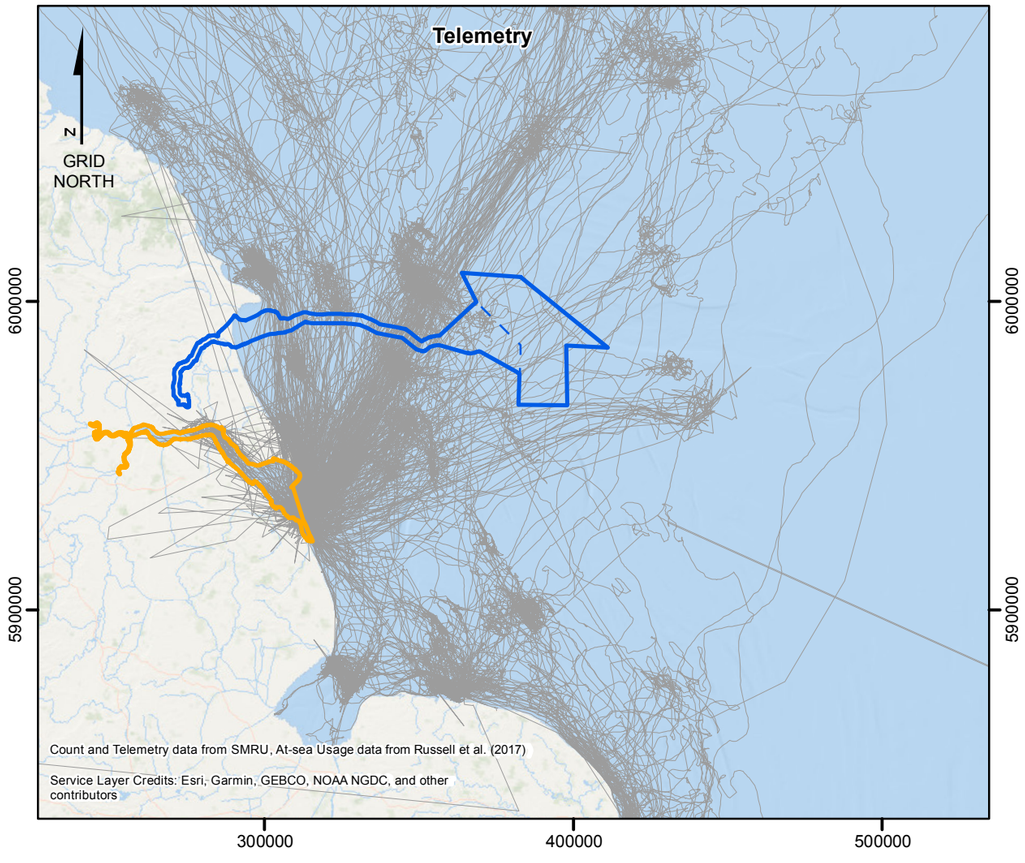
Ørsted

Date: 02/10/2018 Author: Rachael Plunkett Name: H4SR_MM04_Harbour Seal_A3Land_ETRS89

Hornsea Four
Grey Seal Data
Figure 6.25







Scoping Boundary

Array Area

Humber Estuary Special Area of Conservation

Grey Seal August Haul-Out Count 2016

- 1-5
- 6-10
- 11-15
- 16-50
- 51-100
- >100

Grey Seal At-Sea Usage (#/cell)

- 0<1
- 1<5
- 5<10
- 10<50
- 50<100
- >100

Grey Seals Tagged in the Southeast & Northeast England Management Areas (n=70)



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:2013000

0 10 20 40 60 80 100 Kilometres

02.55 10 15 20 25 Nautical Miles

Date: 02/10/2018 Author: Rachael Plunkett Name: H4SR_MM05_Grey Seal_A3Land_ETRS89

Grey Seal Data
Document no: H4SR_MM05
Created by: RP
Checked by: CES
Approved by: CES

SMRU Consulting Europe

Ørsted

6.5.3.5 The following species of marine mammals have been identified most likely to be present at Hornsea Four and will be the focus of the impact assessment:

- Harbour porpoise;
- White-beaked dolphin;
- Minke whale;
- Harbour seal; and
- Grey seal.

6.5.3.6 The key issue for marine mammals is that the data suggests that Hornsea Four is located within an important area for harbour porpoise, as is reflected by the Southern North Sea cSAC designation and in the historical density estimates from the former Hornsea Zone surveys. In addition, the HiDef surveys suggested highly seasonal occurrence of both minke whales and white-beaked dolphins within the Hornsea Four array area, with minke whales only being present in the summer and white-beaked dolphins mainly being present in the winter.

6.5.4 Project Basis for Scoping Assessment

6.5.4.1 The marine mammals scoping assessment is based on the following maximum design scenario:

- the construction of up to 180 WTGs on piled monopile or jacket foundations;
- the construction of up to ten offshore substations, platforms, and accommodation platforms within the array area, and up to three HVAC booster stations along the offshore ECC, all on piled jacket foundations;
- the construction of offshore export cables, inter-array cables and interconnector cables and associated cable protection; and
- the potential clearance of UXOs.

6.5.4.2 The basis for assessment also includes the embedded mitigation (detailed in **section 6.5.5** below) where appropriate.

6.5.5 Embedded Mitigation

6.5.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on marine mammals. These are presented in **Table 6-15**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

6.5.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section 6.5.6** below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 6-15 - Relevant Marine Mammals Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co108	Tertiary: A vessel management plan will be developed which will determine vessel routing to and from construction areas and ports to avoid areas of high risk. This will also include codes of conduct for vessel behaviour and for vessel operators including advice to operators to not deliberately approach marine mammals and to avoid abrupt changes in course or speed should marine mammals approach the vessel to bow-ride.	Secured in the dMLs through the requirement for a PEMMP.
Co109	Tertiary: During piling operations, soft starts will be used, with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.	Secured in the dMLs through the requirement for a MMMP.
Co110	Tertiary: A piling MMMP, approved by the Marine Management Organisation (MMO) in consultation with Natural England, will be implemented during construction. The MMMP will outline monitoring measures to ensure the impact zone is free of marine mammals before piling commences. The details of the MMMP will be agreed with Natural England.	Secured in the dMLs through the requirement for a MMMP.
Co111	Tertiary: A PEMMP (construction and operation phases) and Decommissioning Plan (decommissioning phase) will be produced and followed. The PEMMP and Decommissioning Plan will cover the construction, operation and maintenance, and decommissioning phases of Hornsea Four respectively and will include a Marine Pollution Contingency Plan (MPCP). This MPCP will outline procedures to protect personnel working and to safeguard the marine environment in the event of an accidental pollution event arising from offshore operations relating to Hornsea Four. The MPCP will also outline mitigation measures should an accidental spill occur, address potential contaminant releases and include key emergency contact details (e.g. Environment Agency, Natural England and MCA.	Secured in the dMLs through the requirement for a PEMMP and Decommissioning Programme.
Co112	Tertiary: A UXO specific MMMP, approved by the MMO in consultation with Natural England will be implemented during UXO clearance. The UXO MMMP will use Acoustic Deterrent Devices (ADDs), marine mammal observers and scare charges as the primary mitigation measures alongside other measures as may be agreed with Natural England and the MMO.	Secured in a separate Marine Licence application with a requirement for an UXO MMMP.
Co113	Tertiary: A Decommissioning MMMP, approved by the MMO in consultation with Natural England, will be implemented during decommissioning. The MMMP will outline monitoring measures to ensure the impact zone is free of marine mammals before decommissioning activities commences. The details of the MMMP will be agreed with Natural England.	Secured in the dMLs through the requirement for a Decommissioning Programme.

6.5.6 Likely Significant Effects

6.5.6.1 Table 6-16 sets out an assessment of effects on marine mammals at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea

Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.5.6.2 The assessment presented in **Table 6-16** is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in **Table 6-15**, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for marine mammal effects; relevant policy; the assessment criteria provided in **Annex C**; the question-led approach set out in **section 1.7**; and the professional judgement of qualified marine mammal ecologists.

6.5.6.3 **Table 6-16** is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.5.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

6.5.6.5 The determination of the impacts that are scoped into or out of assessment has been based on a combination of factors, including the results of the marine mammal impact assessment for previous Hornsea Projects and the expert judgement of SMRU Consulting based on involvement in numerous previous impact assessments for offshore wind developments of a similar scale in the UK. The significance of impacts at Hornsea Four are likely to be analogous to those assessed at the previous Hornsea Projects and other Round 3 offshore wind farm developments that are of a similar scale and located in comparable offshore habitat types with the same key marine mammal receptor species present. Thus, it was possible to identify impact pathways that would likely have no significant impact on marine mammals and which could be scoped out of assessment for Hornsea Four. The following sections detail which impact pathways have been scoped into and out of assessment, with detailed justifications provided for the impacts that have been scoped out of assessment.

The following impact pathways have been identified as requiring a detailed assessment:

- Piling Noise: Permanent Threshold Shift (PTS); and
- Piling Noise: Disturbance.

6.5.6.6 The following impact pathways have been identified as requiring a simple assessment:

- Vessel collision risk (construction, operation and decommissioning);
- Vessel disturbance (construction, operation and decommissioning);
- Non-piling noise (construction);
- PTS from UXO clearance[4] (construction);
- Disturbance from UXO clearance (construction);
- PTS from decommissioning (decommissioning); and
- Disturbance from decommissioning (decommissioning).

[4] Note: UXO clearance will not be included in the application at this stage, however a high-level assessment will be provided on the basis of assumptions about the expected level of risk. A detailed assessment of UXO clearance will be developed for a separate Marine Licence at a later stage.

6.5.6.7 The following impact pathways have been scoped out of assessment:

- Temporary Threshold Shift (TTS) (construction, operation and decommissioning);
- Operational noise (operation);
- Reduction in prey availability (construction, operation and decommissioning);
- Reduction in foraging ability (construction, operation and decommissioning);
- Toxic Contamination (construction, operation and decommissioning);
- EMF (operation); and
- Disturbance of haul-out sites (construction).

Table 6-16 - Likely Effects – Marine Mammals

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Construction phase: PTS from piling noise	Tertiary Co109 Co110	Minor	Medium	**Likely significant effect without secondary mitigation** Recent expert elicitation for PTS as a result of pile driving resulted in agreement between experts that the predicted PTS effects from exposure to piling noise (defined as 6 dB PTS in the 2-10 kHz band) was unlikely to have a large effect on the survival or reproduction of the species of interest.	Scoped in A detailed assessment approach will be adopted involving the calculation of the area impacted by piling noise (by the noise modeller) which will be overlain on species specific density surfaces to estimate the number of animals impacted.	None
Construction phase: Disturbance from piling noise	Tertiary Co109 Co110	Minor	Medium	**Likely significant effect without secondary mitigation** Evidence from telemetry and acoustic detection data at previous offshore wind farms show animals are displaced during piling but return after piling ceases.	Scoped in A detailed assessment approach will be adopted involving the calculation of the area impacted by piling noise (by the noise modeller) which will be overlain on species specific density surfaces and combined with a dose-response curve to estimate the number of animals impacted.	None
Construction phase: TTS from piling noise	Tertiary Co109 Co110	Cannot be assessed	Cannot be assessed	**No likely significant effect**	**Scoped out**	None
Construction phase: Vessel collision risk	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels	Scoped in A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during construction activities, existing evidence on marine mammal responses to vessel presence and information on collision related deaths from strandings reports.	Data on baseline vessel activity required
Construction phase: Disturbance from vessels	Tertiary Co108	Minor	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels	Scoped in A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during construction activities and existing evidence on marine mammal responses to vessel presence.	Data on baseline vessel activity required

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Construction phase: Reduction in prey availability	None	Negligible	Low	**No likely significant effect**	**Scoped out**	None
Construction phase: Reduction in foraging ability	None	Negligible	Low	**No likely significant effect**	**Scoped out**	None
Construction phase: Toxic contamination	Tertiary Co111	Negligible	Low	**No likely significant effect**	**Scoped out**	None
Construction phase: Non-piling noise (e.g. cable laying, dredging)	None	Minor	Low	**Likely significant effect without secondary mitigation** It is unlikely that these activities will impact marine mammal receptors at anything other than the immediate proximity.	Scoped in A simple assessment approach will be adopted involving an outline of the duration and likely sound levels from different activities.	None
Construction phase: Disturbance to seal haul-outs at landfall	None	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Construction phase: PTS from UXO clearance[5]	Tertiary Co112	Negligible	Low	**Likely significant effect without secondary mitigation** Magnitude depends on charge size which is currently unknown. Hornsea Project Three predicted Negligible-Low magnitude impacts of PTS for charge sizes up to 260 kg.	Scoped in A simple assessment approach will be adopted involving either the modelling of different charge sizes or using data from different charge sizes from the literature.	None
Construction phase: Disturbance from UXO clearance	Tertiary Co112	Negligible	Low	**Likely significant effect without secondary mitigation** Magnitude depends on charge size which is currently unknown. Hornsea Project Three predicted Negligible-Low magnitude impacts of disturbance out to a 26 km radius due to the short-lived disturbance and low proportion of population predicted to be impacted.	Scoped in A simple assessment approach will be adopted. In the absence of empirical data on the likelihood of response to explosives the assessment will involve the application of a 26 km buffer around a UXO source location to determine the number of animals predicted to be disturbed. This is based on Natural England and JNCC advice that a buffer of 26 km around the source location is used to determine the impact area from UXO clearance with respect to disturbance of harbour	None

[5] Note: UXO clearance will not be included in the application at this stage, however a high level assessment will be provided on the basis of assumptions about the level of risk (recognising that there will not be detailed information on the potential risk of UXO). A detailed assessment of UXO clearance will be developed for a separate Marine Licence at a later stage.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
					porpoise in the Southern North Sea cSAC.	
Construction phase: TTS from UXO clearance	Tertiary Co112	Cannot be assessed	Cannot be assessed	**No likely significant effect**	**Scoped out**	None
Operation phase: Operational noise	None	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Operation phase: Vessel collision risk	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels.	Scoped in A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during operation, existing evidence on marine mammal responses to vessel presence and information on collision related deaths from stranding reports.	As for construction – baseline information on vessel use
Operation phase: Disturbance from vessels	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels.	Scoped in A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during operation and existing evidence on marine mammal responses to vessel presence.	As for construction – baseline information on vessel use
Operation phase: Reduction in prey availability	None	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Operation phase: Reduction in foraging ability	None	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Toxic contamination: Operation phase:	Tertiary Co111	Negligible	Low	**No likely significant effect**	**Scoped out**	None
Operation phase: EMF	None	No change	Negligible	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: PTS from underwater noise	Tertiary Co113	Negligible	Low	**Likely significant effect without secondary mitigation** Depends on the method used to remove structures. Methods such as hot cutting (Brocotorch), diamond wire cutting and abrasive water jet cutting are all expected to have negligible impact due to low noise levels and the temporary nature of the impact.	Scoped in A simple assessment approach will be adopted involving the presentation of expected underwater noise levels produced by various cutting techniques (where available) and an assessment as to whether or	None

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
					not this is likely to impact marine mammals.	
Decommissioning phase: Disturbance from underwater noise	Tertiary Co113	Negligible	Medium	**Likely significant effect without secondary mitigation** Depends on the method used to remove structures. Methods such as hot cutting (Brocotorch), diamond wire cutting and abrasive water jet cutting are all expected to have negligible impact due to low noise levels and the temporary nature of the impact.	Scoped in A simple assessment approach will be adopted involving the presentation of expected underwater noise levels produced by various cutting techniques (where available), the expected duration of activities and an assessment as to whether or not this is likely to impact marine mammals.	None
Decommissioning phase: TTS from underwater noise	Tertiary Co113	Cannot be assessed	Cannot be assessed	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: Vessel collision risk	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels.	Scoped in A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during decommissioning activities, existing evidence on marine mammal responses to vessel presence and information on collision related deaths from stranding reports.	As for construction – baseline information on vessel use
Decommissioning phase: Disturbance from vessels	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels.	Scoped in A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during decommissioning activities and existing evidence on marine mammal responses to vessel presence.	As for construction – baseline information on vessel use
Decommissioning phase: Reduction in prey availability	None	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: Reduction in foraging ability	None	Negligible	Negligible	**No likely significant effect**	**Scoped out**	None
Decommissioning phase: Toxic contamination	Tertiary Co111	Negligible	Low	**No likely significant effect**	**Scoped out**	None

6.5.7 Impacts Scoped Out of Assessment

TTS (Construction, Decommissioning and UXO Clearance)

6.5.7.1 Exposure to loud sounds can result in a reduction in hearing sensitivity. This reduction in sensitivity (threshold shift) can be permanent (PTS) or temporary (TTS). Reductions in hearing sensitivity may affect an animal's ability to forage, avoid predation and communicate but the TTS onset ranges alone do not allow assessment of the magnitude or significance of the likely consequences for individuals and ultimately populations of the predicted extent over which any TTS might occur. The magnitude of the consequence is likely to be related to the duration and magnitude of the TTS. However, the current TTS onset thresholds are inappropriate to determine a biologically significant level of TTS. It is asserted that any effects of TTS, as currently defined, are captured in the period that marine mammals exposed to pile driving noise are predicted to be 'disturbed'. Therefore, a reduction in individual foraging capability as a result of exposure to pile driving noise will be included in the assessment and potential reductions in fitness as a result of noise exposure will be sufficiently captured by the assessment of disturbance.

6.5.7.2 TTS is by definition, temporary, and the duration of effect at the threshold for TTS onset is likely to be short and therefore unlikely to cause any major consequences for an animal. An impact range which encompasses such a large variation in the predicted effect on individuals is extremely difficult to interpret in terms of the potential consequences for individuals. It is important to bear in mind that the quantification of the spatial extent over which any impact is predicted to occur in the environmental assessment process, is done so in order to inform an assessment of the potential magnitude and significance of an impact. Because the TTS thresholds are not intended to indicate a level of impact of concern *per se* but are used to enable the prediction of where PTS might occur, they should not be used for the basis of any assessment of impact significance.

6.5.7.3 Since there are no thresholds to determine a biologically significant effect from TTS and given that disturbance will be included in a detailed quantitative assessment, the impact of TTS on marine mammals is scoped out of assessment.

Operational noise (Operation)

6.5.7.4 The MMO (2014) review of post-consent monitoring at OWFs found that available data on the operational WTG noise, from the UK and abroad, in general showed that noise levels from operational WTGs are low and the spatial extent of the potential impact of the operational WTG noise on marine receptors is generally estimated to be small, with behavioural response only likely at ranges close to the WTG. This is supported by several published studies which provide evidence that marine mammals are not displaced from operational wind farms.

6.5.7.5 At the Horns Rev and Nysted offshore wind farms in Denmark, long-term monitoring showed that both harbour porpoise and harbour seals were sighted regularly within the operational OWFs, and within two years of operation, the populations had returned to levels that were comparable with the wider area (Diederichs et al., 2008). Similarly, a monitoring programme at the Egmond aan Zee OWF in the Netherlands reported that significantly more porpoise activity was recorded within the OWF compared to the reference area during the operational phase (Scheidat et al., 2011). Other studies at Dutch and Danish OWFs (e.g. Lindeboom et al., 2011) also suggest that harbour porpoise may be attracted to increased foraging opportunities within operating offshore wind farms. In addition, recent tagging work by Russell et al. (2014) found that some tagged harbour and

grey seals demonstrated grid-like movement patterns as these animals moved between individual WTGs, strongly suggestive of these structures being used for foraging.

6.5.7.6 Other reviews have also concluded that operational wind farm noise will have negligible effects (Madsen et al., 2006, Teilmann et al., 2006, Brasseur et al., 2012, CEFAS, 2010). Tagged seals have shown targeted foraging behaviour around operational offshore wind farms (Russell et al., 2014) which suggests that they act as fish aggregating devices, providing enhanced or novel foraging opportunities. In addition studies have shown that porpoise are detected regularly within operational offshore wind farms (Diederichs et al., 2008, Scheidat et al., 2011) and may be attracted to offshore wind farms for increased foraging opportunities (Lindeboom et al., 2011). Therefore, the sensitivity of marine mammals is also expected to be negligible. In addition, modelling conducted for Hornsea Project Three concluded that underwater noise during the operational phase is expected to have a negligible range of influence on any marine receptors. As a result of existing evidence on the effects of operational noise, including modelling work carried out for the Hornsea Project Three assessment, this impact is scoped out of assessment.

Reduction in prey availability (Construction, Operation and Decommissioning)

6.5.7.7 Given that marine mammals are dependent on fish prey, there is the potential for indirect effects on marine mammals as a result of impacts upon fish species or on the habitats that support them. However, if significant effects on prey species or the habitats supporting them are not predicted, it is reasonable to assume that secondary effects on marine mammals would also not be significant. Therefore, it is proposed that a reduction in prey ability is scoped out of all stages of the assessment unless the Benthic and Intertidal Ecology and Fish and Shellfish Ecology assessments identify any significant impacts on marine mammal prey species.

6.5.7.8 It is also possible that operational wind farms may actually increase prey availability. As described above, tagged seals have shown targeted foraging behaviour around operational offshore wind farms which suggests that they act as fish aggregating devices, providing enhanced or novel foraging opportunities (Russell et al., 2014). In addition, studies have shown that porpoise are detected regularly within operational offshore wind farms (e.g. Diederichs et al 2008; Scheidat et al 2011) and may be attracted to offshore wind farms for increased foraging opportunities (e.g. Lindeboom et al 2011). Therefore, it is possible that the underwater structures associated with Hornsea Four could provide an ecological benefit by providing new foraging opportunities to marine mammals in the area. Any potential habitat change as a result of fish aggregation or artificial reefs is expected to positively affect marine mammals by providing novel foraging opportunities. Therefore, no adverse impact is expected and so this impact is scoped out of further assessment.

Reduction in foraging ability (Construction, Operation and Decommissioning)

6.5.7.9 Disturbance to water quality as a result of construction operations can have both direct and indirect impacts on marine mammals. Indirect impacts would include effects on prey species which have already been covered in the previous section.

6.5.7.10 Direct impacts include the impairment of visibility and therefore foraging ability which might be expected to reduce foraging success. However, it is not expected that there will be significant levels of increased suspended sediment as a result of the construction, operation and decommissioning of Hornsea Four.

6.5.7.11 In addition, marine mammals are well known to forage in tidal areas where water conditions are turbid and visibility conditions poor. For example, harbour porpoise and harbour seals in the UK have been documented foraging in areas with high tidal flows (e.g. Pierpoint 2008, Marubini et al., 2009, Hastie et al., 2016); therefore, low light levels, turbid waters and suspended sediments are unlikely to negatively impact marine mammal foraging success. When the visual sensory systems of marine mammals are compromised, they are able to sense the environment in other ways, for example, seals can detect water movements and hydrodynamic trails with their mystacial vibrissae; while odontocetes primarily use echolocation to navigate and find food in darkness.

6.5.7.12 Therefore, the sensitivity to increased suspended sediment concentration (SSC) is low for marine mammals. The expected magnitude of impact related to decreased foraging opportunities as a result of increased SSC levels is low for all marine mammal species and so this impact is scoped out of assessment.

Toxic contamination (Construction, Operation and Decommissioning)

6.5.7.13 It is not expected that there will be any risk of toxic contamination from accidental spillages during construction, operation and decommissioning activities and any such risk would be temporary in nature. The development of an MPCP will include measures to be adopted for the prevention of pollution events and outline an emergency plan to be implemented in the unlikely event of any pollution events. Given the how unlikely a pollution event is, in conjunction with an MPCP, the magnitude of pollution events occurring at Hornsea Project Three was assessed as negligible and the same magnitude would be adopted for Hornsea Four. It is also not expected that there will be a significant risk in the leaching of toxic compounds during the Operational phase. Therefore, this impact is scoped out of assessment.

EMF (Operation)

6.5.7.14 Based on the data available to date, there is no evidence of electromagnetic fields (EMF) related to marine renewable devices having any impact (either positive or negative) on marine mammals (Copping, 2018). There is no evidence that seals can detect or respond to EMF, however, some species of cetaceans may be able to detect variations in magnetic fields (Normandeau et al., 2011). To date, the only marine mammal known to show any response to EMF is the Guiana dolphin (*Sotalia guianensis*) which has been shown to possess an electroreceptive system, which uses the vibrissal crypts on their rostrum to detect electrical stimuli similar to those generated by small to medium sized fish (Czech-Damal et al., 2013). However, this has not been shown in any other species of marine mammal.

6.5.7.15 Given that marine mammals are known to closely associate with offshore wind farm structures, it is predicted that the magnitude and vulnerability score for this impact would be Negligible, therefore this impact is scoped out of assessment.

Disturbance of haul-out sites (Construction)

6.5.7.16 There are no grey or harbour seal haul-outs sites in the vicinity of the land-fall site based on the SMRU August haul-out count surveys, nor is there evidence from the at-sea and total usage maps or the available telemetry data that harbour seals use the landfall area in any significant numbers. The closest main haul-out site is Donna Nook which is >50 km away

from the scoping boundary at the landfall. It is not expected that landfall activities during construction will impact seal haul-outs, therefore this impact is scoped out of assessment.

6.5.8 Proposed Approach to the PEIR and ES

Overview

6.5.8.1 The following section provides an overview of the proposed impact assessment methodology that will be adopted for marine mammals. This includes the proposed auditory injury (PTS) thresholds and the proposed approach to the disturbance assessment.

Auditory injury (PTS) Thresholds

6.5.8.2 Unless any new guidance is published prior to the impact assessment, the National Marine Fisheries Service (2016) thresholds will be used to assess the risk of PTS (often referred to as the "NOAA Thresholds"). The risk of injury will be based on both of the dual criteria: cumulative sound exposure level (SELcum) and peak sound pressure level (peak SPL) (**Table 6-17**). To assess the SELcum criterion, the predictions of received sound level over 24 hours are frequency weighted, to reflect the hearing sensitivity of each functional hearing group. The peak SPL criterion is for unweighted received sound level.

Table 6-17 - National Marine Fisheries Service (2016) PTS thresholds for pulsed noise that will be used in this assessment for each of the marine mammal hearing groups

Hearing Group	Species	SEL_{cum} [dB re 1 µPa^2 s] weighted according to NMFS (2016) audiogram weighting functions for each hearing group	Peak SPL [dB re 1 µPa] unweighted
Low-frequency cetaceans	Minke whale	183	219
Mid-frequency cetaceans	White-beaked dolphin	185	230
High-Frequency cetaceans	Harbour porpoise	155	202
Phocids	Harbour seal, grey seal	185	218

Marine Mammal Sensitivity to PTS

6.5.8.3 At a recent BEIS funded expert elicitation workshop, experts in marine mammal hearing discussed the nature, extent and potential consequence of PTS to UK marine mammal species including harbour porpoise, bottlenose dolphins, harbour seals and grey seals (Booth and Heinis, 2018) as a result of exposure to pile driving noise (note, minke whales were previously assessed in 2013 – see Harwood et al., 2014). Experts agreed that any threshold shifts as a result of pile driving would manifest themselves somewhere in the 2-10 kHz range (Kastelein et al. 2017)(Finneran, 2015). Most piling noise is relatively low frequency, and therefore the effect of PTS is predicted to manifest as a small "notch" within the 2-10 kHz frequency range and the effect on all cetacean species may be minimal. In light of this, a PTS of 6 dB in a narrow frequency band within the 2-10 kHz region is unlikely to significantly affect the fitness of individuals which rely on broadband and/or high frequency signals. Effects were considered to be smallest for porpoises and seals and slightly larger in bottlenose dolphins, though experts noted that the broader range of plausible outcomes for dolphins was due to potential uncertainty in how the

defined PTS would impact dolphins (which use lower frequency for communications and for some foraging calls), not necessarily that they were definitely more sensitive. Therefore, it is proposed that the sensitivity score for cetaceans will be assessed as medium and for seals as low.

Disturbance Assessment

6.5.8.4 The assessment of disturbance will be based on the best practice methodology at the time of assessment, making use of the best available scientific evidence. It is likely based on current practice that the methodology will incorporate the application of a species-specific dose-response approach rather than a fixed behavioural threshold approach. Noise contours at appropriate intervals will likely be generated by noise modelling and overlain on species density surfaces to predict the number of animals potentially disturbed. This will allow the quantification of the number of animals that potentially will respond.

Baseline Characterisation

6.5.8.5 Detailed analysis of additional datasets will be utilised to further characterise the spatial and temporal distribution of marine mammals across the area and predict the potential impacts upon the populations, including:

- processing of the monthly HiDef Aerial Surveying Limited aerial surveys of the Hornsea Four array area plus 4 km buffer, conducted between April 2016 and March 2018 to provide sightings rates per unit of effort;
- available data on movements between UK and European seal haul-out sites will be examined to inform the baseline and further define appropriate wider reference populations for both seal species (e.g. Brasseur et al., 2010, Brasseur, 2017, Vincent et al., 2017);
- addition of any further baseline abundance and density information available (e.g. updated seal counts in SCOS 2018, SCANS III density surfaces); and
- detailed descriptions of the assumptions and limitations of each dataset used to inform the baseline characterisation for each species.

6.5.9 Scoping Questions for Consultees

6.5.9.1 Scoping questions for consultees in relation to marine mammals include:

1. Do you agree that the data sources identified are likely to be sufficient to inform the marine mammal baseline for the Hornsea Four PEIR and ES?
2. Have all potential impacts resulting from Hornsea Four been identified for marine mammal receptors?
3. Do you agree with the proposed approach to assessment (scoped in or out, and detailed or simple assessment) for each of the impacts in the Likely Significant Effects table for marine mammals?
4. Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of Hornsea Four on marine mammal receptors?
5. For those impacts scoped in, does you agree that the methods described are sufficient to inform a robust impact assessment?
6. Do you have any specific requirements for the noise modelling methodology?

6.6 Offshore and Intertidal Ornithology

6.6.1 Introduction

6.6.1.1 This section of the Scoping Report identifies the offshore and intertidal ornithology receptors of relevance to the assessment of the potential impacts of Hornsea Four. Those receptors are primarily the bird species that are collectively called seabirds and shorebirds. It considers the potential effects from the construction, operation (including maintenance) and decommissioning of the offshore and intertidal components (i.e. seaward of MHWS) of Hornsea Four on offshore and intertidal ornithology receptors.

6.6.2 Study Area

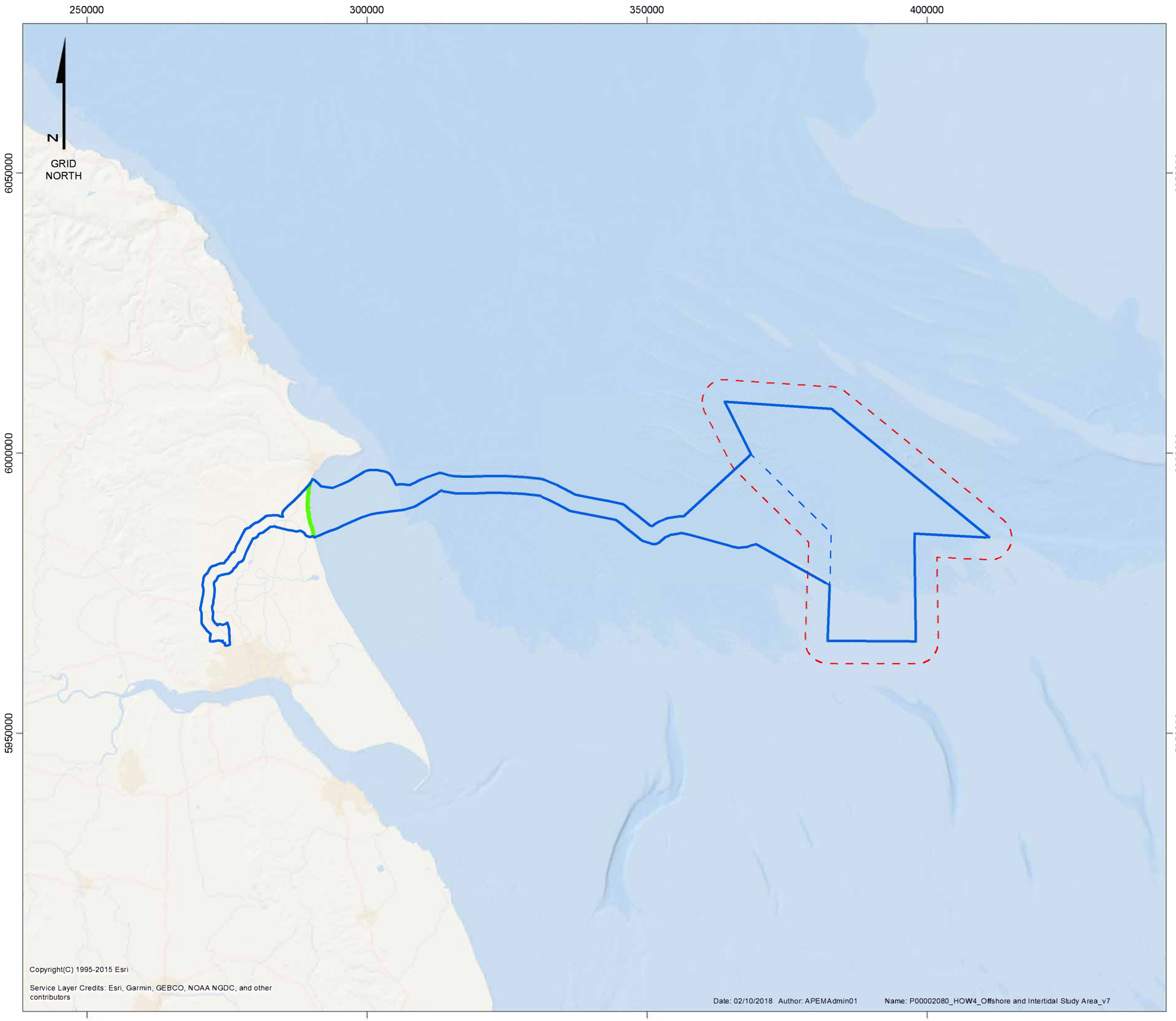
6.6.2.1 Hornsea Four is located in the Southern North Sea, with WTGs positioned at their closest point approximately 65 km off the Yorkshire, UK, mainland. The array area covers 846 km^2. The scoping boundary for the project includes the Hornsea Four array area and a corridor for the offshore export cable (offshore ECC) from the array to the landfall area. The landfall will be at a yet to be determined location on the coast roughly between Bridlington to the north and Skipsea to the south.

6.6.2.2 The study area for the offshore and intertidal ornithology receptors includes all of the sea and coasts within these areas with a particular focus on the sea within a 4 km buffer surrounding the Hornsea Four array area, the latter of which follows Natural England recommendations. Account also has to be taken of the mobility of birds, noting that for instance, birds that nest outside the study area might fly in to or across the study area to feed during the breeding season, might fly into the study area outside of the breeding season to spend the winter or might fly across the study area on migration.

6.6.2.3 For the purposes of this section a split between offshore and intertidal is required in order to refine the focus of the ornithological assessments. The intertidal area and related assessments considers birds using the habitat mostly between MHWS and MLWS, recognising that some of these birds might nest or roost on the shore above MHWS. The offshore area and related assessments considers birds using the habitat seaward of MLWS within the offshore ECC out to the array area and a 4 km buffer surrounding it.

6.6.2.4 The study area for offshore and intertidal ornithology is shown in **Figure 6-26.**

Hornsea Four
Offshore and Intertidal Study Area
Figure 6.26



6.6.3 Baseline Environment

6.6.3.1 An initial desk-based review of literature and data sources has been undertaken to support this Scoping Report. The data sources listed below provide coverage of the study area and the wider region of interest for offshore and intertidal bird species.

6.6.3.2 It should be noted that the information sources, guidelines, assessment methodologies and reports applied in this Scoping Report is not comprehensive and is not intended to provide all the information required for the future impact assessment. In addition, ornithological assessment for offshore wind farms is a developing field with new and up-to-date information and evidence bases coming into the public domain on a regular basis. Such new information will be considered as and when available and applicable at the relevant stage of the assessment process.

Data Sources used for Scoping: Offshore

6.6.3.3 The data sources detailed in **Table 6-18** provide species specific information on the distribution, abundance, biological seasons, behaviour and characteristics of birds in the offshore environment that have been used to characterise the study area for the purposes of scoping (and will be referred to within the impact assessment).

Table 6-18 - Key Sources of Offshore Ornithology Data

Source	Summary	Coverage of Hornsea Four array area and ECC
Hornsea Four aerial surveys	HiDef Digital Aerial Surveying Ltd. conducted monthly surveys between April 2016 and March 2018, using the aerial digital video method, sampling 10% of the area and recording all bird species that occurred in the 10% sample.	Hornsea Four array area plus 4 km buffer spatially sampled with transects that provided 10% coverage.
Hornsea Project Three aerial surveys	HiDef Digital Aerial Surveying Ltd. conducted monthly surveys between April 2016 and November 2017, using the aerial digital video method, sampling 10% of the area and recording all bird species that occurred in the 10% sample.	There was no overlap in coverage between Hornsea Project Three and Hornsea Four. The survey results provide context for Hornsea Four.
Hornsea Project Two aerial surveys	APEM Ltd conducted 12 surveys between June 2012 and February 2013, using the aerial digital stills method, sampling 10% of the Project Two array area and a 4 km buffer and recording all bird species that occurred in the 10% sample.	Hornsea Project Two is adjacent to Hornsea Four and as a result the survey covered some of south eastern part and its 4 km buffer.
Former Hornsea zone aerial surveys	APEM Ltd conducted 12 surveys between June 2012 and February 2013, using the aerial digital stills method, sampling 4% of the former zone and recording all bird species that occurred in the 4% sample.	Hornsea Four array area included within the surveys of the former zone.
Hornsea Project Three boat based surveys	There were no project specific boat based surveys of the array area or buffer but it was included with a low coverage through the former Hornsea zone surveys.	Hornsea Four array area included within the surveys of the former zone.

Source	Summary	Coverage of Hornsea Four array area and ECC
Hornsea Project Two boat based surveys	Boat based transect surveys conducted monthly between March 2010 and February 2013 of the array area and a 4 km buffer	Hornsea Project Two is adjacent to Hornsea Four and as a result the survey covered some of south eastern part and its 4 km buffer.
Hornsea Project One boat based surveys	Boat based transect surveys conducted monthly between March 2010 and February 2013 of the array area and a 4 km buffer.	There was no overlap in coverage between Hornsea Project One and Hornsea Four. The survey results provide context for Hornsea Four.
Former Hornsea zone boat based surveys	Boat based transect surveys of the former Hornsea Zone plus a 10 km buffer between March 2010 and February 2013.	Hornsea Four array area included within the surveys of the former zone.
RSPB 2018	Report and data relating to tracking studies conducted of breeding kittiwake from the Flamborough area.	Tracks identified that birds flew in a wide arc from the breeding colony with some using the Hornsea Four array area and ECC.
Langston & Teuten 2018	Final report on study of the tracking of breeding gannet from the Flamborough area during 2010-12.	Tracks identified that birds flew in a wide arc from the breeding colony with some using the Hornsea Four array area and ECC.
Hornsea Project Three	The ES and its appendices provide information on seabird diversity and population estimates for a nearby area of sea (Ørsted, 2018).	The ES information provides context for Hornsea Four.
Hornsea Project Two	The ES and its appendices provide information on seabird diversity and population estimates for a nearby area of sea (SMart Wind, 2015).	The ES information provides context for Hornsea Four.
Hornsea Project One	The ES and its appendices provide information on seabird diversity and population estimates for a nearby area of sea (SMart Wind, 2013).	The ES information provides context for Hornsea Four.
Peer reviewed literature	Published, peer reviewed scientific papers on seabird behaviour and characteristics e.g. Robinson, 2018; Thaxter et al, 2012; Furness et al, 2018.	These covered an area of marine waters that was specific to the study. Those studies conducted on a North Sea or UK waters basis would have covered the Hornsea Four array area and ECC.
OWF grey literature	Post-consent monitoring reports on seabirds and offshore wind farms e.g. Royal Haskoning, 2013.	These covered the array area and a buffer of other particular OWFs.
OWF assessment methodologies	Publications on assessment methodologies for seabirds and OWFs e.g. Maclean et al, 2009; Wright et al, 2012; SNCBs, 2017; Band 2012; Cook et al, 2018.	These contain generic methods that have to be applied in the site specific circumstances of Hornsea Four.
Seabird Atlases	Publications on seabird distribution and movements within UK waters and further afield e.g. Stone et al, 1995; Stienen et al, 2007; Wernham et al, 2002.	These contain information that can be drawn upon that is specific to Hornsea Four, coastal waters off north east England or as wide as the North Sea.
Seabird population estimates	Publications on seabird, waterbird and other bird species population estimates for the UK and wider regions e.g. BTO WeBS online, 2018; Furness, 2015; Musgrove et al,, 2013; Mitchell et al, 2004.	These contain information that can be drawn upon that is specific to Hornsea Four, coastal waters off north east England or as wide as the North Sea.

6.6.3.4 The data sources detailed in Table 6-19 provide species-specific information on the distribution, abundance, biological seasons, behaviour and characteristics of birds in the intertidal area that have been used to characterise Hornsea Four for the purposes of scoping (and will be referred to within the impact assessment).

Table 6-19 - Key sources of intertidal ornithology data for Hornsea Four

Source	Summary	Coverage of Hornsea Four array area and ECC
British Trust for Ornithology (undated)	Co-ordinated counts of the non-estuarine shoreline (covering supratidal, intertidal and ~1 km in to coastal waters) in the winters of 1984/85, 1997/98, 2006/07 and 2015/16 originally under the title of the 'Winter Shorebird Count' and for the most recent three times under the title of 'Non-Estuarine Waterbird Survey'	Each of the four winter surveys had consistent coverage of the stretch of coast that coincides with the scoping boundary of the ECC.
National Bird Atlas 2007-11 (Balmer et al, 2013)	Results of five years of breeding season and winter surveys across the UK showing at a 10 km square scale the distribution, relative density and change over recent years for all frequently occurring bird species.	The scoping boundary of the ECC overlaps primarily with 10 km squares TA15 & TA16.
Yorkshire Bird Reports	An annual publication summarising bird sightings and survey results for Yorkshire.	Counts of birds that were considered to be notable by the Report editors are listed for the Holderness coast and specific location along it, including those within the scoping boundary of the ECC.
Dogger Bank Creyke Beck (A&B) OWF surveys (Forewind, 2013)	Bird surveys were carried out at, and within a buffer around, the OWF cable landfall on the Holderness coast.	The Dogger Bank Creyke Beck (A&B) OWF surveys overlap with the scoping boundary of the ECC.

Overview of Baseline Environment

The North Sea

6.6.3.5 This section provides a high-level overview of the offshore ornithology baseline environment for the former Hornsea Zone in the context of the existing understanding of North Sea bird populations. This wider area is useful for providing a wider context for determining changes in distribution and abundance within and between years and also increases the probability of capturing migratory movements for relatively rare species.

6.6.3.6 Extensive ornithological surveys (e.g. Stone et al., 1995); the results from previous Round 1 and 2 offshore wind farm baseline surveys, evaluations carried out for their Environmental Statements and monitoring reports; bird tracking studies (e.g. Frederikson et al., 2012; Langston & Tueten 2018); biogeographic population reviews (e.g. Stienen et al., 2007; Furness, 2015); and the analysis of population distribution (e.g. Bradbury et al., 2014; Wakefield et al., 2017) have shown that the North Sea offshore ornithology study area is an important area for seabirds. This includes during passage and in winter months when British breeding birds are joined by birds that have migrated from continental Europe and Fennoscandia. Because of the mix of birds present, it is probable that the former Hornsea

Zone is used at different times by birds (i) overwintering in the area; (ii) foraging from nearby breeding coastal colonies; and (iii) on post-breeding dispersal, migration and pre-breeding return.

6.6.3.7 As well as true pelagic seabirds (e.g. gannet, fulmars and auks), other species that spend part of their annual life cycle at sea (e.g. divers, gulls and seaducks) may also be present in particular months, with numbers of non-seabird migrants also present during relevant migratory periods (e.g. wildfowl, waders and passerines). Stienen et al. (2007) demonstrated that the southern North Sea area is an important corridor for migration of some seabird species in particular. For instance, the great majority (40-100%) of the flyway population of great skua pass through the North Sea, leaving by the Strait of Dover, as well as 30-70% of the lesser black-backed gull population.

Hornsea Four Array Area

6.6.3.8 Site specific offshore ornithological surveys were carried out between 2004 and 2018 to characterise the bird communities across the former Hornsea Zone, as well as the particular development areas of Hornsea Project One, Hornsea Project Two, Hornsea Project Three and Hornsea Four.

6.6.3.9 Table 6-20 summarises the seabird population estimates from the 24 months of site-specific aerial video digital surveys for Hornsea Four conducted by HiDef on a monthly basis between April 2016 and March 2018, inclusive.

6.6.3.10 The survey methods used for Hornsea Four were the same as those used to collect data for use in the recent Hornsea Project Three ES, these methods having been agreed with SNCBs through the Hornsea Project Three Evidence Plan Process (Ørsted, 2018b). The surveys cover the entire Hornsea Four array area and a 4 km buffer surrounding it. Data were collected along transects spaced 2.5 km apart across the survey area, providing for data collection representing a minimum of 10% coverage.

6.6.3.11 The primary observations from the two years of data are as follows:

- fulmar were consistently recorded in all months, peaking in May in Year 1 and April in Year 2;
- gannet were also recorded in each of the 24 months, peaking in June in Year 1 and November in Year 2;
- the most abundant small gull was kittiwake, recorded in each month, with numbers peaking between April and September across Year 1 and Year 2;
- large gull species were less common, with great black-backed gull the most abundant species peaking in February in Year 1 and December in Year 2;
- the most abundant species recorded in each of the 24 months was guillemot, peaking in September in Year 1 and August in Year 2;
- razorbill were recorded in all 24 months, peaking in September in Year 1 and August in Year 2;
- puffin were recorded in eight of the 24 surveys, peaking in July in Year 1 and August in Year 2; and
- other species recorded, but not presented in Table 6-20 due to being recorded in low numbers and a limited number of monthly surveys, include red-throated diver, Manx shearwater, lapwing, curlew, Arctic skua, great skua, little gull, black-headed gull, common gull, Arctic tern, common tern, Sandwich tern, little auk, feral pigeon and starling.

6.6.3.12 The main species of interest for the impact assessment work for Hornsea Four will therefore be those listed in **Table 6-20**. The main features of offshore ornithological interest are likely to occur in the breeding and post-breeding periods. This is most likely due to these species being associated with the Flamborough and Filey Coast (FFC) proposed Special Protection Area (pSPA) that is approx. 65 km from the Hornsea Four array area.

6.6.3.13 Of the main species of interest for Hornsea Four, three species (gannet, kittiwake and guillemot) are presented in heatmaps in **Figure 6-27** in order to provide an early indication of the most abundant species, their distribution within the array area and out to a 4 km buffer surrounding it. These heatmaps use averaged bird abundances from 24 months of survey data split within two broad biological seasons (breeding season and non-breeding season) according to Furness (2015). The maps make use of the heatmap plug-in in QGIS and were prepared using flying bird abundances only for gannet and kittiwake, whilst using sitting birds only for guillemot.

6.6.3.14 Initial interpretation of the heatmaps in **Figure 6-27** show that during the breeding season gannets are loosely distributed across the entire array area and 4 km buffer and that during the non-breeding season there are areas of higher abundances in the north, east and south. For kittiwake there are higher abundances in the south of the array area and 4 km buffer during both the breeding and non-breeding season, with localised areas of higher abundance to the northwest and east during the non-breeding season. Guillemot abundances are greatest in the south of the array area and 4 km buffer during the breeding season, whilst highest abundances are within the south, north and east during the non-breeding season.

Hornsea Four
Gannet Breeding Abundance
Figure 6.27a

350000

400000

6000000

5950000

N

GRID NORTH

Array Area

Gannet Breeding Abundance

- 0 - 2.33
- 2.34 - 5.28
- 5.29 - 8.37
- 8.38 - 12.24
- 12.25 - 19.41



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:300000

0 1.75 3.5 7 10.5 14 Kilometres

0 2 4 8 Nautical Miles

Copyright(C) 1995-2015 Esri

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

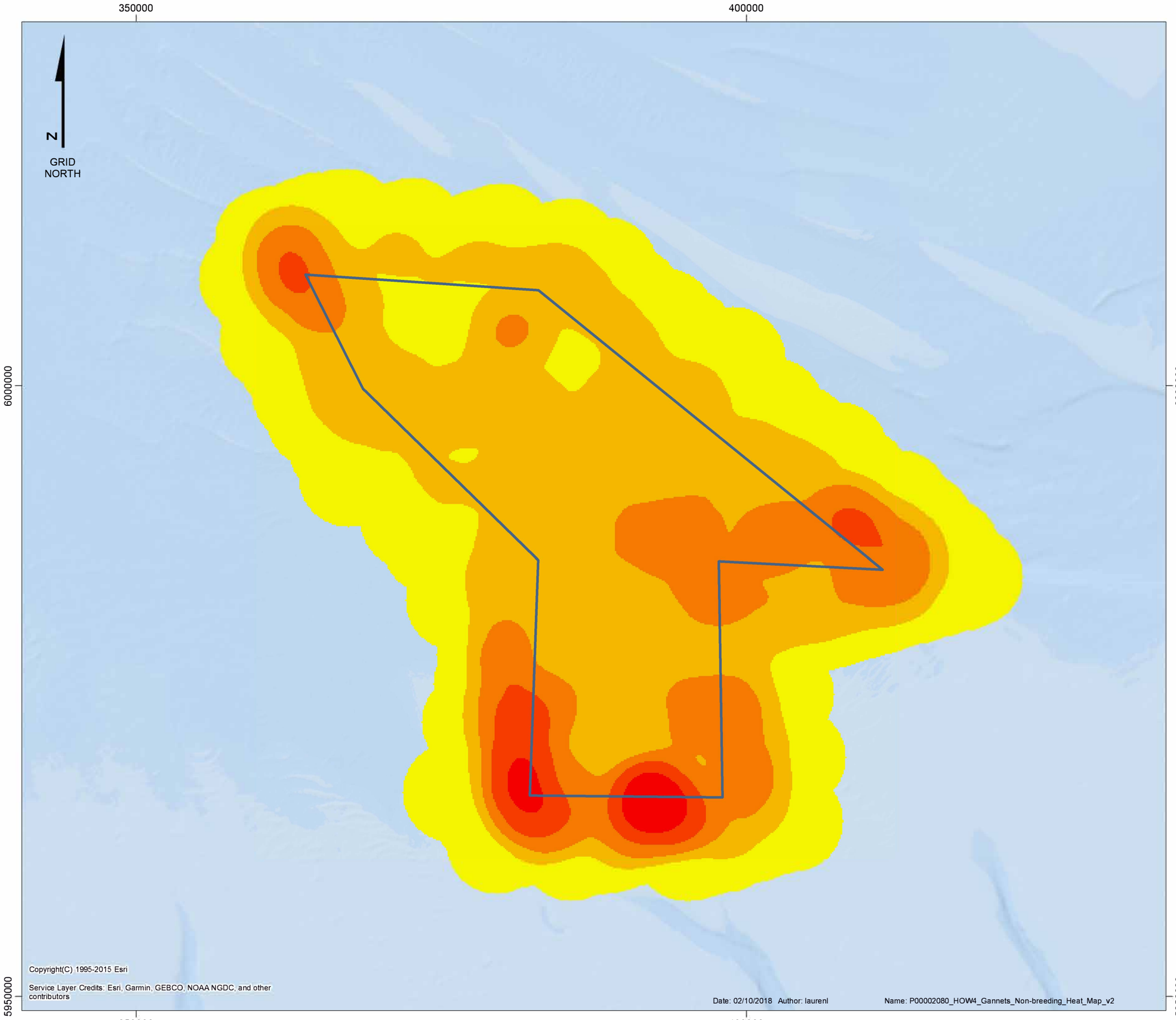
Date: 02/10/2018 Author: laurenl Name: P00002080_HOW4_Gannets_Breeding_Heat_Map_v2

Gannet Breeding Abundance
Document no: H4SR_OR02a
Created by: BG
Checked by: SS
Approved by: RB

APEM

Ørsted

Hornsea Four
Gannet Non-breeding Abundance Figure 6.27b



Array Area

Gannet Non-breeding Abundance

- 0 - 105.52
- 105.53 - 286.12
- 286.13 - 580.35
- 580.36 - 1,091.71
- 1,091.72 - 2,027.17



Coordinate system: ETRS 1989 UTM Zone 31N

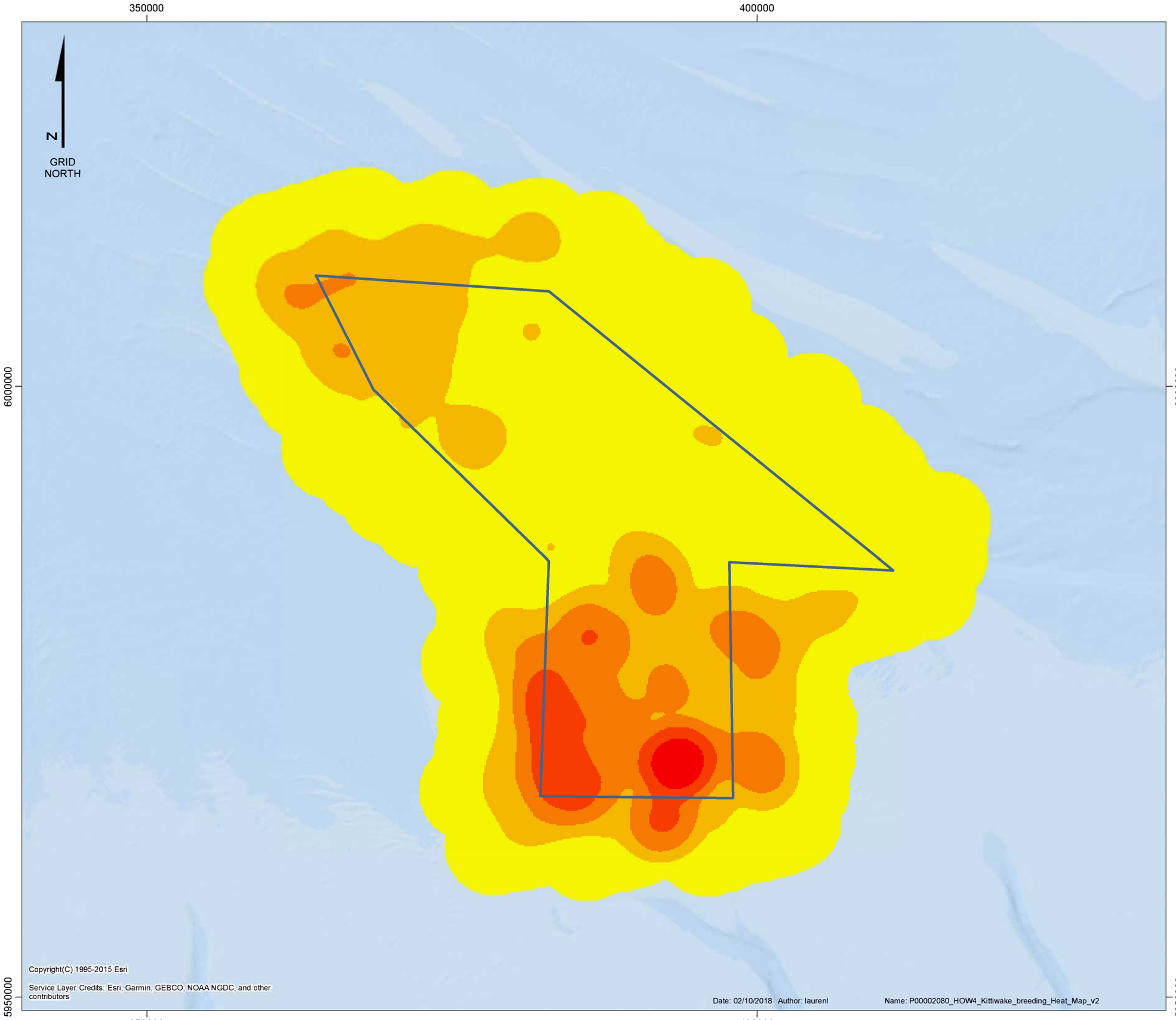
Scale@A3: 1:300000

0 1.75 3.5 7 10.5 14 Kilometres

0 2 4 8 Nautical Miles

Gannet Non-breeding Abundance
Document no: H4SR_OR02b
Created by: BG
Checked by: SS
Approved by: RB

Hornsea Four
Kittiwake Breeding Abundance
Figure 6.27c



350000

400000

N

GRID
NORTH

6000000

6000000

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Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Date: 02/10/2018 Author: laurenl

Name: P00002080_HOW4_Kittiwake_Non-breeding_Heat_Map_v2

350000

400000

Hornsea Four

Kittiwake Non-breeding Abundance

Figure 6.27d

Array Area

Kittiwake Non-breeding Abundance

- 0 - 8.61
- 8.62 - 21.92
- 21.93 - 44.31
- 44.32 - 81.41
- 81.42 - 156.41



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:300000

0 1.75 3.5 7 10.5 14 Kilometres

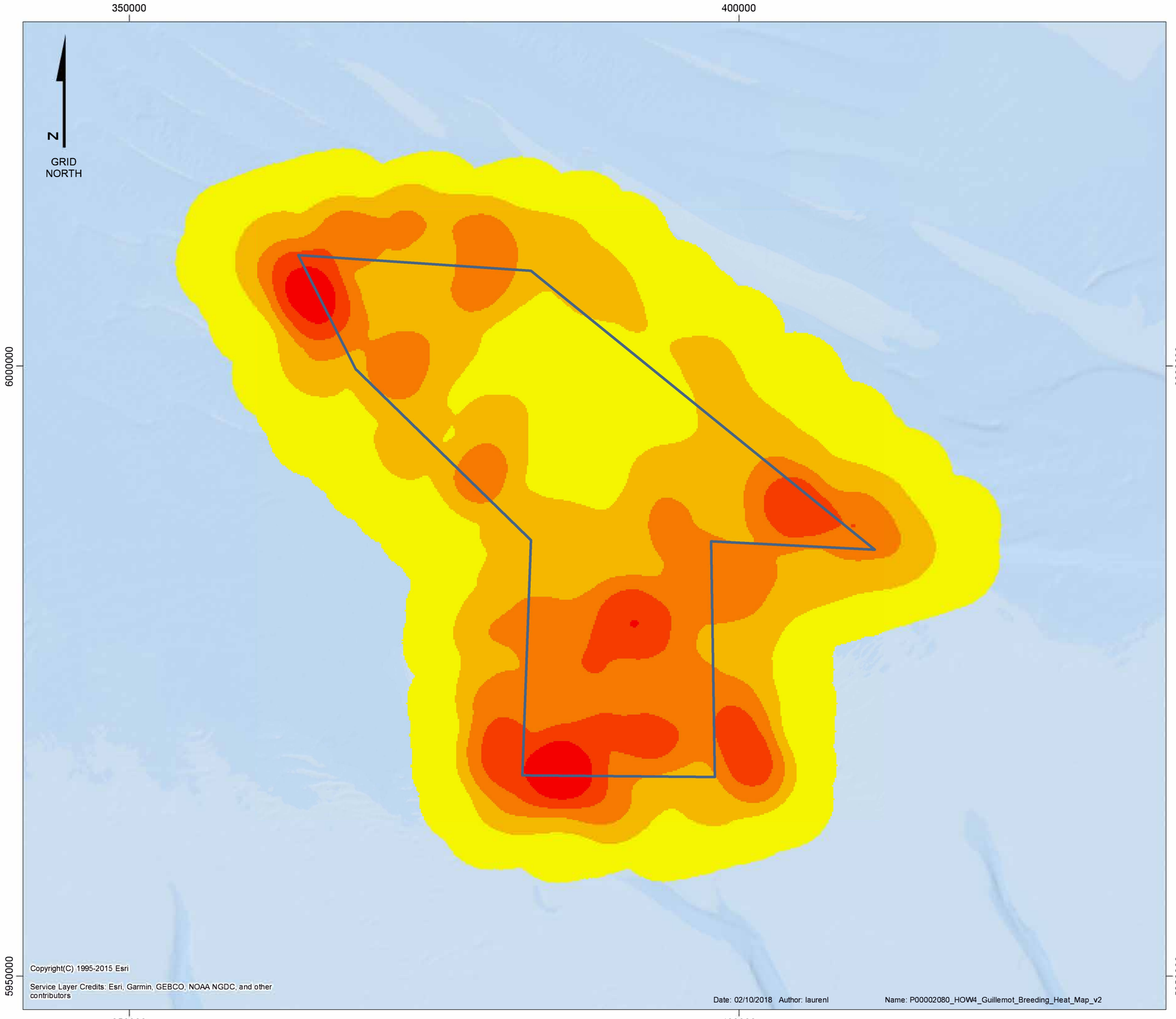
0 2 4 8 Nautical Miles

Kittiwake Non-breeding Abundance
Document no: H4SR_OR02d
Created by: BG
Checked by: SS
Approved by: RB

APEM

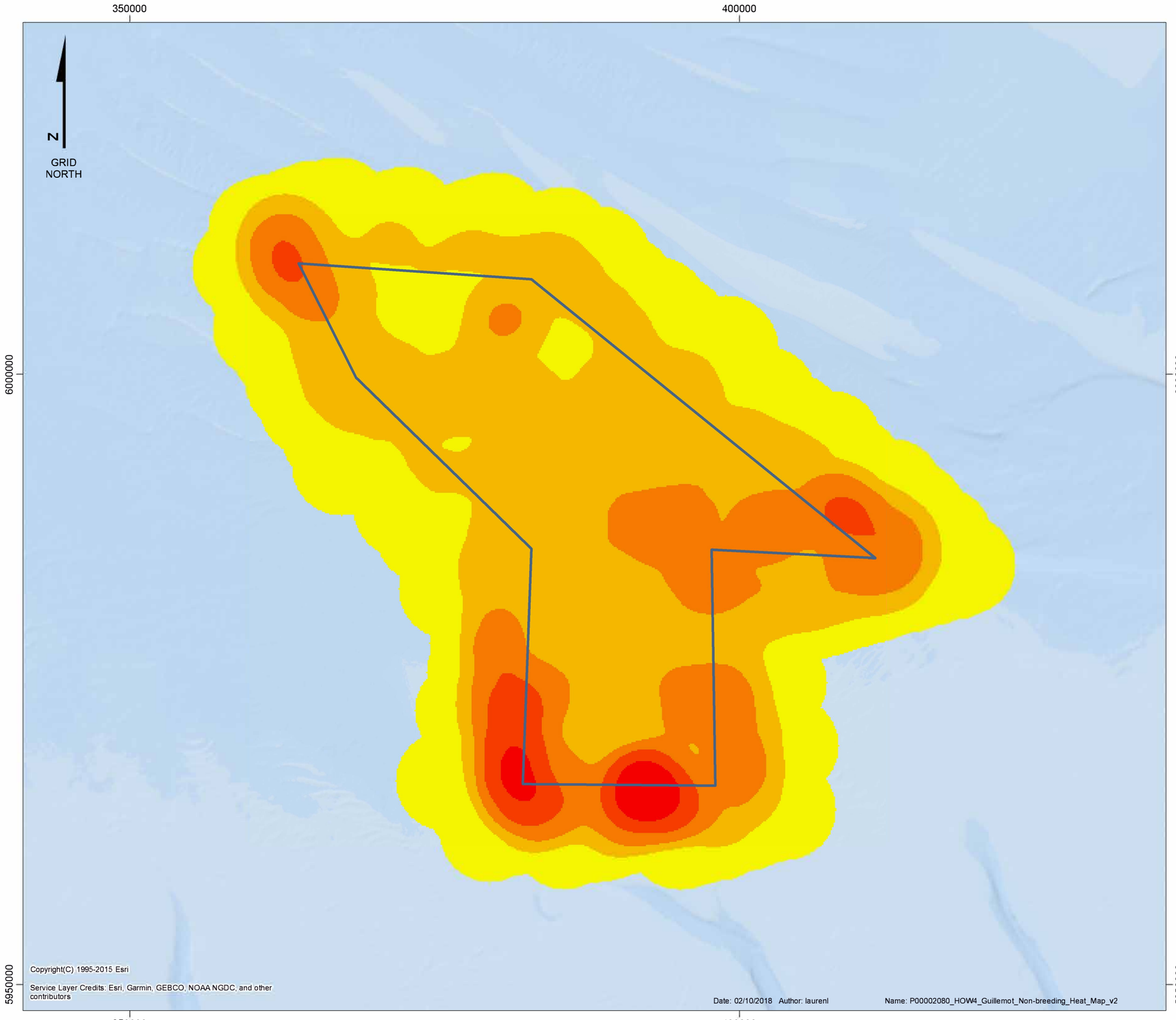
Ørsted

Hornsea Four
Guillemot Breeding Abundance
Figure 6.27e



Guillemot Breeding Abundance
Document no: H4SR_OR02e
Created by: BG
Checked by: SS
Approved by: RB

Hornsea Four
Guillemot Non-breeding Abundance
Figure 6.27f



Guillemot Non-breeding Abundance
Document no: H4SR_OR02f
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Checked by: SS
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Biological seasons and reference populations for use in Hornsea Four

6.6.3.15 The offshore ornithology assessment and analysis of survey data for Hornsea Four will consider seasonal differences in site usage by the main species, as well as the importance for the site for the stages of the life cycle for each species. Determining the relevant biological seasons for each of the main seabird species will, where applicable, follow those recommended by Furness (2015), though it is anticipated that some localised variations may be applicable dependent upon further analysis of the 24 months of data from the entire survey area (including the 4 km buffer) and the other available data on seabirds from the former Hornsea zone.

6.6.3.16 Reference populations for each species and their population sizes will be based on the best available information at the time of undertaking the assessment and will be agreed with key stakeholders through the Evidence Plan process. The initial source of data will be sought from Furness (2015), whilst more localised data relating to specific seabird colonies will be sought through more up to date references.

Table 6-20 – Population estimates of most abundant seabird species in Project Four area (not including 4 km buffer) for the two years of data collection (April 2016 to March 2018)

Month / Species	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Fulmar	1	280	619*	352	40	30	40	358	61	60	250	140	190
	2	240	125	40	40	110	161	25	20	61	120	140	90
Gannet	1	292	710*	1,829	460	451	483	573	709	500	0	90	311
	2	391	693	161	927	791	361	766	963	570	232	0	90
Kittiwake	1	3,035	4,870*	3,463	2,354	8,566	5,780	261	161	391	361	30	451
	2	18,892	6,182	2,073	847	8,956	741	259	500	2,231	220	651	281
Lesser black-backed gull	1	n/a	n/a*	20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2	n/a	52	10	n/a	10	n/a	n/a	n/a	n/a	n/a	n/a	10
Herring gull	1	n/a	n/a*	20	10	n/a	n/a	n/a	n/a	10	n/a	11	n/a
	2	11	n/a	n/a	n/a	11	10	n/a	n/a	11	n/a	10	11
Great black-backed gull	1	n/a	n/a*	11	n/a	n/a	40	71	101	150	230	271	50
	2	n/a	11	11	n/a	n/a	n/a	n/a	180	319	170	81	101
Guillemot	1	4,427	7,488*	11,636	11,520	35,240	38,792	13,900	5,354	1,821	4,177	4,741	6,724
	2	21,822	12,187	2,534	9,828	35,791	13,893	2,442	14,285	7,829	2,563	3,726	1,804
Razorbill	1	220	91*	440	91	1,386	7,098	2,035	833	21	617	100	461
	2	1,086	1,241	121	130	3,684	1,361	224	773	1,107	60	717	260
Puffin	1	330	40*	21	703	251	71	242	n/a	n/a	n/a	31	20
	2	120	218	20	51	650	422	n/a	n/a	11	10	100	n/a

Table Note: *=May 2016 survey actually flown in early June 2016. n/a = refers to potentially small number of birds present, but not identified to species level at this stage.

6.6.3.17 The intertidal environment of the Holderness coast of East Yorkshire is dominated by mobile, sandy beaches backed by low, soft cliffs and sand dunes and is an area of active erosion. It is bounded by the chalk cliffs of Flamborough Head to the north and the Humber Estuary to the south. The Holderness coast itself lacks any significant areas of intertidal estuary or muddy habitats. The result is that as a habitat for intertidal birds it provides limited food resources and the populations of birds using the coast is as a result very low.

6.6.3.18 A programme of national counts of birds along the UK's non-estuarine shoreline was conducted in 1984/85, 1997/98, 2006/07 and 2015/16, originally under the title of the 'Winter Shorebird Count' and for the most recent three times under the title of 'Non-Estuarine Waterbird Survey' (https://www.bto.org/volunteer-surveys/webs/taking-part/non-estuarine-waterbird-survey-iii). The Holderness coast was covered in this programme and the results published by the British Trust for Ornithology (BTO) (http://www.bto.org/volunteer-surveys/webs/publications/webs-annual-report). For the stretch of coast from Hilderthorpe to Skipsea (this covers the scoping boundary for the proposed offshore ECC landfall) **Table 6-21** presents the peak winter count of birds (expressed as within a range of values in the manner published by the BTO) from that programme of non-estuarine waterbird counts. This stretch of coast was counted completely and consistently between surveys. Also included in that table are the thresholds for identifying a site of national importance for each species (https://www.bto.org/volunteer-surveys/webs/data/species-threshold-levels) and the population estimate for the East Yorkshire coast in 2015/16 determined from the non-estuarine waterbird counts of that winter. The latter gives a measure of the county population only for those species that are habitat specialists of sandy coasts since for many species such as dunlin a much larger population will occur on the Humber Estuary that is outside the scope of the survey programme.

Table 6-21 - Non-estuarine waterbird peak winter counts for the coast from Hilderthorpe to Skipsea

Survey Species	1985	1997/98	2006/07	2015/16	E. Yorks coastal population	Great Britain 1% threshold
Shelduck	0	0	0	0	3	3,000
Wigeon	0	0	0	0	39	4,400
Mallard	0	0	1-20	11-20	11	6,800
Common Scoter	0	1-50	0	0	5	1,000
Goldeneye	0	0	0	0	3	200
Goosander	0	0	0	0	3	120
Red-throated Diver	0	0	0	0	42	170
Great Northern Diver	0	0	0	0	1	25
Cormorant	0	0	0	3-30	81	350
Shag	0	0	0	0	6	1,100
Grey Heron	0	0	0	0	1	610
Little Grebe	0	0	0	0	8	160
Great Crested Grebe	0	1-20	0	4-6	5	190
Slavonian Grebe	0	0	0	0	3	11
Oystercatcher	1-10	21-40	3-30	3-30	148	3,200
Golden Plover	0	0	0	9-12	10	4,000
Lapwing	0	0	0	0	6	6,200

Survey Species	1985	1997/98	2006/07	2015/16	E. Yorks coastal population	Great Britain 1% threshold
Ringed Plover	0	61-90	1-3	61-90	112	340
Curlew	0	0	1-10	0	10	1,400
Turnstone	0	31-60	0	1-40	221	480
Sanderling	1-40	61-90	1-20	41-60	77	160
Dunlin	1-20	41-80	1-3	11-20	31	3,500
Purple Sandpiper	0	1-20	0	0	2	130
Redshank	1-30	1-50	1-20	1-10	75	1,200
Snipe	0	0	0	0	1	10,000
Black-headed Gull	nc	nc	nc	1-60	493	22,000
Mediterranean Gull	nc	nc	nc	0	1	18
Common Gull	nc	nc	nc	1-200	1,590	7,000
Lesser Black-bd Gull	nc	nc	nc	11-20	30	1,200
Herring Gull	nc	nc	nc	201-400	1,527	1,300
Great Black-bd Gull	nc	nc	nc	3-30	147	760

Table note: nc = no count recorded

6.6.3.19 The consented Dogger Bank Creyke Beck (A & B) offshore wind farm has an export cable landfall on the Holderness coast near Ulrome, to the north of Skipsea and within the scoping boundary for the proposed Hornsea Four offshore ECC landfall. As part of the characterisation of the intertidal ornithological interest of the cable landfall site a wintering bird survey was conducted in 2011/12 of the coast between Ulrome and Barmston (Forewind, 2013). The peak counts from this survey are presented in **Table 6-22** (reproduced from Table 3.43 of Forewind, 2013). Since the counts cover a shorter length of coast than those counts presented in **Table 6-21** above, they can be expected to have recorded lower numbers of birds.

Table 6-22 - Wintering waterbird peak counts for the coast between Ulrome and Barmston (Forewind, 2013)

Species	2011/12
Wigeon	0
Mallard	0
Common Scoter	0
Red-throated Diver	0
Cormorant	0
Great Crested Grebe	0
Oystercatcher	2
Lapwing	0
Ringed Plover	2
Turnstone	2
Knot	1
Sanderling	8
Dunlin	0
Bar-tailed Godwit	1
Redshank	11
Black-headed Gull	15
Common Gull	593
Herring Gull	0
Great Black-backed Gull	17

6.6.3.20 The national atlas of breeding and wintering birds (Balmer et al., 2013) provides information on the range of species that can be associated with the intertidal environment. This can provide a measure of diversity but for information on numbers, the wintering waterbird counts referred to above are better suited to evaluating the wintering bird populations for impact assessment purposes. No bird is able to breed within the intertidal zone but the national atlas identifies the following species that breed along the open coast and that can be associated with feeding in the intertidal environment from Hilderthorpe to Skipsea during the breeding season: Shelduck, oystercatcher and herring gull. Birds that breed and feed in the vegetation above MHWS are addressed in the onshore ecology chapter of this scoping report (**section 7.3**).

6.6.3.21 The Yorkshire Bird Report (YNU, 2015) provides information on all species recorded in the county, though a finer scale report is available for East Yorkshire that is not included in this review. The report provides an overview of birds recorded with the intertidal and nearshore environment, with records of breeding and wintering numbers highlighted where considered of significance locally or regionally. However, records within county bird reports are, often, focussed on particular locations where birdwatchers frequent on a regular basis and do not systematically cover entire stretches of coastline, so should not be the sole source of data used in order to evaluate bird populations for impact assessment purposes.

6.6.3.22 The Yorkshire Bird Report 2012 (YNU, 2015) refers to no species of duck, wader, gull or tern breeding within or in close proximity to the intertidal zone along the coast between Hilderthorpe and Skipsea. However, notable records of birds recording on migration or during the non-breeding (wintering period) are referred to throughout the report. The counts recorded within the Yorkshire Bird Report 2012 (YNU, 2015) are presented in **Table 6-23**, with commentary with regards to the time of year and location of the records. None of the species were recorded in peak numbers that are above the 1% of the national populations for the given season, the common threshold for consideration within impact assessments.

Table 6-23 - Waterbirds recorded in Yorkshire Bird Report 2012 and 2013 (YNU, 2015 and YNU, 2018) between Hilderthorpe (south Bridlington) and Skipsea.

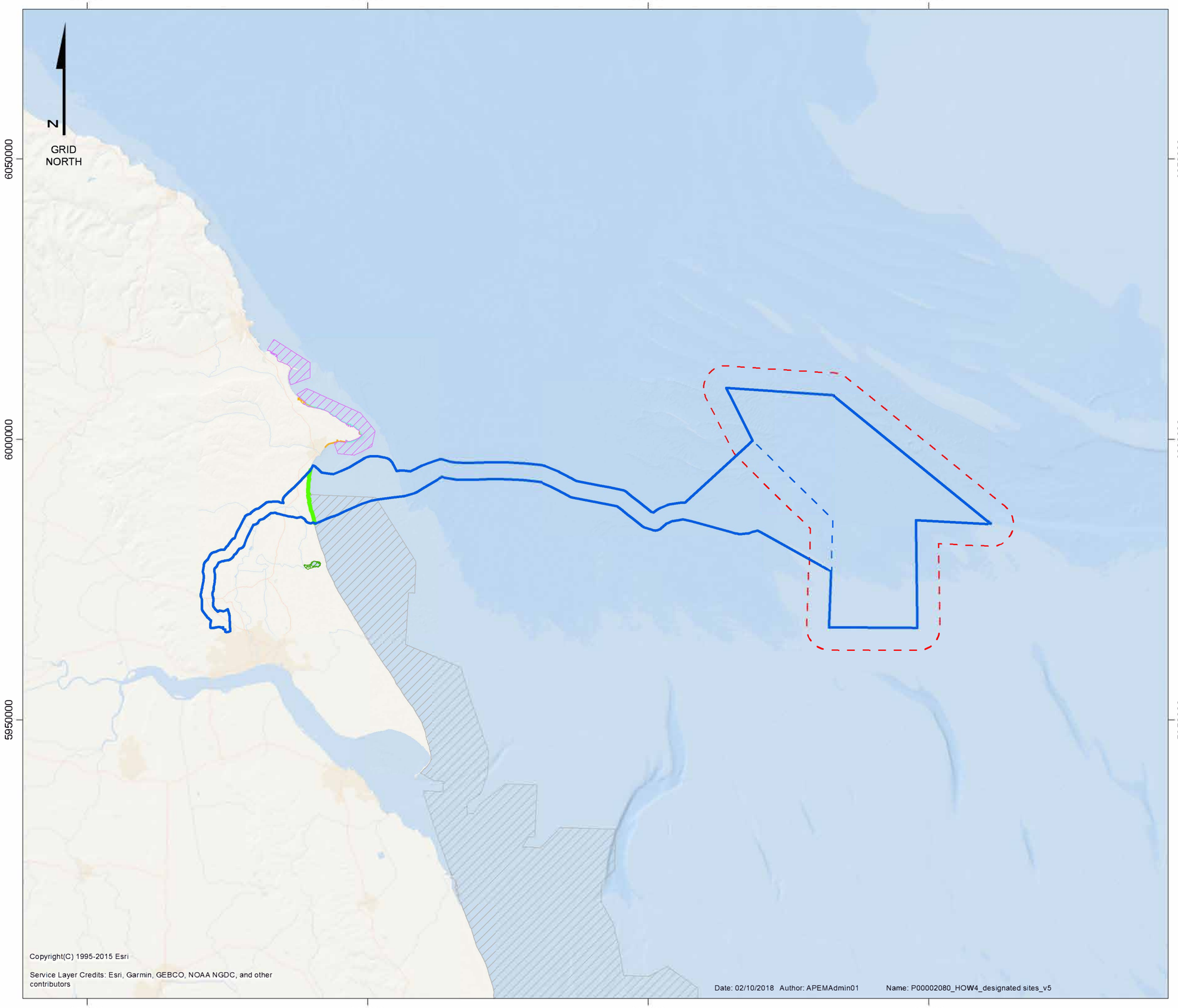
Species	Annual Report Year	Count	Month	Comment
Common Scoter	2012	1,000	January	Flying north off Barmston coast
Goldeneye	2012	17	October	Flying north off Bridlington coast
Goosander	2012	2	June	Flying north off Barmston coast (Unseasonable record)
Red-throated Diver	2012	176	January	Flying north off Barmston coast
	2013	227	February	Offshore between Atwick & Barmston
Great Northern Diver	2012	1 to 11	Jan-Mar	Off Barmston coast
Cormorant	2012	186	March	Flying north off Barmston coast (Significant record)
Shag	2013	300+	n/a	North Bridlington Bay
Great Crested Grebe	2012	41	March	Off Barmston coast
	2013	26 / 35 / 27	Jan / Mar / Nov	Off Barmston coast (Jan) and between Barmston & Atwick (Mar & Nov)
Slavonian Grebe	2012	1	Jan	Off Barmston coast
Oystercatcher	2013	180	February	Barmston coastline

Species	Annual Report Year	Count	Month	Comment
Ringed Plover	2012	61	January	Barmston coastline
Turnstone	2012	60 / 85	Jan / Dec	Shoreline south of Bridlington
	2013	36	Jul	Barmston coastline
Sanderling	2012	150 / 160 / 24	Feb / Mar / Jul	All records on coastline at Barmston, with the latter record of migrants moving south
	2013	295 / 200	Jan / Jan	Barmston / Bridlington
Purple Sandpiper	2012	1+	winter	Described as low single numbers over winter period on shoreline at Barmston.
	2013	3	winter	Barmston
Redshank	2013	316	Jul	Flying south off Barmston
Little tern	2012	3-4	May-Jul	North or South passage movements offshore from Barmston

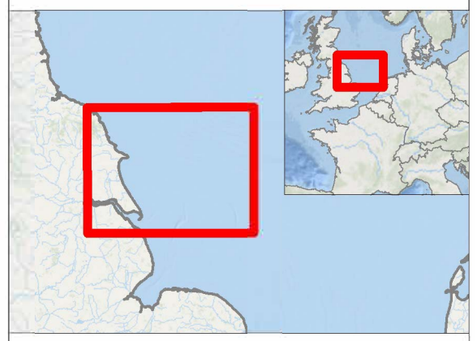
Designated Sites

6.6.3.23 For this Scoping Report an initial review has been undertaken to identify the key designated sites with ornithology interest features that are likely to form the central focus of future assessments. These consist of the following sites, which are presented in relation to the study area in **Figure 6-28**.

Hornsea Four
Study Area and Designated Sites Figure 6.28



- Scoping Boundary
- Array Area
- Flamborough and Filey Coast pSPA
- Flamborough Head and Bempton Cliffs SPA
- Greater Wash SPA
- Flamborough Head SSSI
- Hornsea Mere SSSI
- Array Area 4 km Buffer
- Intertidal Study Area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:653250

0 4 8 16 24 32 Kilometres

0 2 4 8 12 Nautical Miles

Study Area and Designated Sites
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Checked by: SS
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6.6.3.24 For the PEIR and ES wider more fine scale reviews of designated sites for offshore and intertidal ornithology will be undertaken, considering potential connectivity of receptors within the study area. In addition, a Habitats Regulations Assessment (HRA) screening report has been submitted alongside this scoping report to identify those Special Protection Areas (SPAs) likely to be affected by or interact with Hornsea Four that will be screened into the HRA process.

6.6.3.25 The key sites identified in relation to ornithological interest are as follows.

- **The FFC pSPA** is ~8,040 ha in area, encompassing terrestrial, coastal and marine habitats supporting breeding seabirds both when they are nesting and when using the nearshore sea surface (extending out to ~2 km) for activities such as displaying, washing and preening. The interest features of this site are breeding gannet, razorbill, guillemot and kittiwake and a breeding seabird assemblage of those four species and fulmar as main components with cormorant, shag, herring gull and puffin also part of the breeding seabird assemblage (Natural England, 2014). The FFC pSPA is approximately 64 km to the west of the Hornsea Four array area and the offshore ECC has a very minor overlap with the southern extent of the FFC pSPA. All of the interest feature species have been recorded within the Hornsea Four array area during the breeding season.
- **The Flamborough Head and Bempton Cliffs (FHBC) SPA** is ~207 ha in area, encompassing terrestrial and coastal habitats. The area of the FHBC SPA is contained completely within the FFC pSPA and the FHBC SPA does not extend beyond mean low water. The interest feature of this site is kittiwake. Although supporting a seabird breeding assemblage, that assemblage does not form part of the site interest features. The FHBC SPA is approximately 66 km to the west of the Hornsea Four array area and it has no overlap with the offshore ECC. Kittiwake has been recorded within the Hornsea Four array area during the breeding season.
- **The Greater Wash SPA** is ~353,580 ha in area, encompassing coastal and marine habitats and extending along the east coast of England between Bridlington Bay in the north and Great Yarmouth in the south. The boundary on the landward side is at mean high water and the seaward boundary is ~14 nautical miles from the shore at its furthest extent. The interest features of this site are non-breeding red-throated diver, non-breeding common scoter, non-breeding little gull, breeding Sandwich tern, breeding common tern and breeding little tern. The Hornsea Four array area is outside of the SPA and beyond the mean-max foraging range during the breeding season for all three of the tern species that are interest features. The offshore ECC overlaps with the northernmost extent of the SPA. Red-throated diver, little gull, Sandwich tern and common tern have been recorded within the Hornsea Four array area.
- **Flamborough Head Site of Special Scientific Interest (SSSI)** is ~318 ha in area, encompassing terrestrial and coastal habitats. The area of the SSSI extends beyond the area of the FHBC SPA as its interest features include grassland habitats and geological features but it does not extend beyond mean low water. The notified bird interest features are breeding fulmar, gannet, kittiwake, guillemot, razorbill and puffin. The SSSI is approximately 66 km to the west of the Hornsea Four array area and it has no overlap with the offshore ECC. All of the interest feature species have been recorded within the Hornsea Four array area during the breeding season.
- **Hornsea Mere SSSI and SPA** is a terrestrial wetland site 7.3km to the south of the southern extent of the proposed offshore ECC landfall scoping boundary and is noted here for the large concentration of little gull that use this site in the late summer to wash and preen. These little gulls will feed in the offshore environment and are an interest feature of the Greater Wash SPA. Little gull is not an interest feature of the Hornsea Mere SSSI nor the Hornsea Mere SPA.

Summary and Key Issues

6.6.3.26 The key species recorded in the most recent surveys in the Hornsea Four array area (April 2016 to March 2018) that will form the focus of this Scoping Report include the following species: fulmar, gannet, great black-backed gull, herring gull, kittiwake, puffin, razorbill and guillemot.

6.6.3.27 The key species for the offshore ECC area is considered to be red-throated diver which is known to be sensitive to vessel traffic and is an interest feature of the Greater Wash SPA (a designated site that overlaps with the offshore ECC area).

6.6.3.28 Bird occurrence is deemed insignificant within the intertidal environment at the proposed landfall area with no species identified as of sufficient concern to be scoped in for detailed impact assessment.

6.6.4 Project Basis for Scoping Assessment

6.6.4.1 The offshore and intertidal ornithology scoping assessment is based on the following maximum design scenario:

- the construction of up to 180 WTGs with a maximum rotor diameter of 305 m mounted on monopile structure foundations with associated seabed preparation, piling and scour protection;
- the construction of up to ten offshore substations, platforms, and accommodation platforms within the array area, and up to three HVAC booster stations along the offshore ECC, all on piled jacket structure foundations with associated seabed preparation, piling and scour protection;
- the construction of offshore export cables, inter-array cables and interconnector cables and associated cable protection; and
- open trenching through the intertidal area in preparation for the installation of the offshore export cables at the landfall.

6.6.4.2 The basis for assessment also includes the embedded mitigation (detailed in **section 6.6.5** below) where appropriate.

6.6.5 Embedded Mitigation

6.6.5.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed to reduce the potential for impacts on ornithology receptors. These are presented in **Table 6-24**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

6.6.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section**

6.6.6 (i.e. the determination of magnitude of impact and significance of effect assumes implementation of these measures).

Table 6-24– Relevant Offshore and Intertidal Ornithology Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co86	Primary: The proposed offshore cable corridor and cable landfall (below MHWS) will avoid all statutory marine designated areas.	Secured by means of the Order limits as defined in the DCO and dMLs.
Co88	Tertiary: Construction and operational maintenance vessels will follow a route from their home port that avoids high concentrations of red-throated diver (a species known to be sensitive to disturbance by boat traffic).	Secured in the dMLs through the requirement for a Construction Method Statement (CMS).
Co101	Primary: Air draught clearance of blades greater than 22m MHWS 23,8m Mean Sea Level (MSL)	Secured in the dMLs through the requirement for a Design Plan.
Co138	Primary: Raised lower airdraft of WTG turbines to minimum of 35 m MSL instead of 22 m LAT	Secured in the dMLs through the requirement for a Design Plan.

6.6.6 Likely Significant Effects

6.6.6.1 Table 6-25 sets out an assessment of effects on offshore and intertidal ornithology at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.6.6.2 The assessment presented in Table 6-25 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 6-24, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for offshore and intertidal ornithology effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified ornithologists.

6.6.6.3 Table 6-25 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.6.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 6-25 Likely Effects - Offshore and Intertidal Ornithology

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Disturbance / displacement: Construction phase Construction activities within the array area associated with foundations and WTGs may lead to disturbance and displacement of species within the array and different degrees of buffers surrounding it.	Tertiary Co86 Co88	Negligible to Minor	Negligible to High	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor depending on species assessed. This is due to any potential impacts being minimised spatially to a small number of foundations and / or WTGs at any one time and temporally due to the construction phase being limited in time.	Scoped in Simple Assessment based on the WCS considered for the most sensitive species, most likely to be guillemot and razorbill.	Offshore Ornithology baseline data on seabirds within array and specific buffer surrounding it (this data is already available). Data on construction timetable and the period over which it will be undertaken.
Indirect habitat loss: Construction phase Indirect impacts during the construction phase within the array area through effects on habitats and prey species.	None	Negligible	Negligible to Low	**No likely significant effect**	**Scoped Out**	Dependent upon baseline of other chapters such as benthic / fish.
Disturbance / displacement: Construction phase Construction activities associated with export cable laying may lead to disturbance and displacement of species within the export cable corridor and different degrees of buffers surrounding it.	Primary Co88	Negligible to Minor	Negligible to Medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor depending on species assessed. This is due to any potential impacts being minimised spatially to a single cable laying vessel and temporally due to the construction phase being limited in time. Also, the most sensitive species (divers) are not found in high densities within study area.	Scoped in Simple Assessment based on the WCS, which in this instance is considered for most the sensitive species such as auks and divers.	Offshore Ornithology baseline data on seabirds within the study area (including the array, a 4 km buffer and the export cable corridor). Data on the construction timetable and the period over which it will be undertaken.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Disturbance / displacement: Construction phase Construction activities associated with trenching, laying and reburial of the export cable through the intertidal zone may lead to disturbance and displacement of waterbird species in close proximity to the works.	None	Negligible	Negligible	**Likely significant effect without secondary mitigation** LSE is not significant, as very few waterbirds reside within the intertidal area and most species are tolerant of disturbance activities that are limited spatially and temporally.	Scoped in Simple Assessment based on similar projects within region and case study examples.	Desk based review to ascertain species of interest. Unlikely that any new surveys would be required, due to previous OWF project data and other recent data sources covering this stretch of coastline.
Disturbance / displacement: Operational phase Operational activities associated with moving turbines and maintenance vessels may lead to disturbance and displacement of species within the array area and different degrees of buffers surrounding it.	None	Negligible to Moderate	Negligible to Medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor/moderate depending on species assessed.	Scoped in Detailed assessment required to assess species of interest and their distribution (within the Array area, a suitable buffer) and the relevant biological period of interest.	Offshore Ornithology baseline data required on seabirds within array and specific buffer surrounding it (this data is already available). Information on the maintenance schedule.
Collision risk: Operational phase Seabirds flying through the array area during the operational phase are at risk of collision with WTG rotors and associated infrastructure. The result of such collisions may be fatal to the bird concerned.	Primary Co101 Co138	Negligible to Moderate	Negligible to High	**Likely significant effect without secondary mitigation** LSE likely to be between not significant and moderate / major, as initial consideration of collision risk highlighted as key consideration for the Hornsea Four project. Risk resulting from in-combination effects with other OWFs is greatest.	Scoped in Detailed Assessment as Hornsea Four is the closest of all Hornsea OWF projects to the FFC pSPA seabird colony	Offshore Ornithology baseline data required on flying seabirds within array (this data is already available). Information on the number of WTGs and preparation of the Worst Case Scenario for CRM.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Collision risk: Operational phase Migrant non-seabirds flying through the array area during the operational phase are at risk of collision with WTG rotors and associated infrastructure. The result of such collisions may be fatal to the bird concerned.	None	Negligible	Negligible to Medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant or minor as previous impact assessments conducted for OWFs in the North Sea have concluded negligible or minor. There are no reasons why this project would be deemed any different.	Scoped in Simple assessment based on similar projects within region and case study examples.	Previous Hornsea projects can provide initial data for consideration in this assessment.
Indirect habitat loss: Operational phase Indirect impacts within the array area during the operational phase through effects on habitats and prey species.	None	Negligible	Negligible to Low	**No likely significant effect**	**Scoped out**	Dependent upon baseline of other chapters such as benthic / fish.
Barrier to movement: Operational phase The presence of WTGs could create a barrier to the migratory or regular foraging movements of seabirds. This may result in permanent changes in flying routes for birds concerned and an increase in energy demands associated with those movements may result in a lower rate of breeding success or survival chances for individuals affected.	None	Negligible to Minor	Negligible to Medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor. This impact is not widely assessed as being significant and displacement impacts are considered to be the more important focus.	Scoped in Simple assessment Hornsea Four is the closest of the Hornsea projects to the seabird breeding colonies of the FFC pSPA and as such presents a risk of creating a barrier to adult birds seeking to forage during the chick rearing stage in sea areas beyond the development boundary.	Offshore Ornithology baseline data required on seabirds within array and specific buffer surrounding it (these data are already available). Tracking study data and recent peer reviewed papers and OWF EIAs on this topic.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Disturbance / displacement: Operational phase Potential for ad-hoc maintenance of export cable throughout operational phase, which may lead to disturbance and displacement of species within the export cable corridor and different degrees of buffers surrounding it.	None	Negligible	Negligible to Low	**No likely significant effect**	**Scoped out**	Desk based review to ascertain species of interest characterised in baseline report.
Disturbance / displacement: Operational phase Potential for ad-hoc maintenance of export cable through the intertidal zone during the operational phase may lead to disturbance and displacement of waterbird species in close proximity to the works.	Tertiary Co86 Co88	Negligible	Negligible	**No likely significant effect**	**Scoped out**	Desk based review to ascertain species of interest characterised in baseline report.
Disturbance / displacement: Decommissioning phase Demolition activities associated with foundations and WTGs may lead to disturbance and displacement of species within the array area and different degrees of buffers surrounding it.	Tertiary Co86 Co88	Negligible to Minor	Negligible to Low	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor as species are less sensitive to lower scale activities associated with decommissioning.	Scoped in Simple assessment required to assess species of interest and their distribution (within the Array area).	This is reliant upon the agreed potential LSE of construction & operational displacement assessments.
Indirect habitat loss: Decommissioning phase Indirect impacts during the decommissioning phase within the offshore export cable corridor and landfall through effects on habitats and prey species.	None	Negligible	Negligible	**No likely significant effect**	**Scoped out**	Dependent upon baseline of other chapters on benthic / fish.

6.6.7 Impacts Scoped Out of Assessment

6.6.7.1 The following sections provide a summary of why particular impact pathways were scoped out of the assessment.

Indirect habitat loss (Construction and Decommissioning)

6.6.7.2 For the birds that have been identified as making use of the array area, the offshore ECC and the intertidal landfall, there is the potential for indirect effects acting on them as a result of impacts upon their prey (primarily fish species for the seabirds and primarily invertebrates for the shorebirds) or on the habitats that support their prey. However, if significant effects on prey species or the habitats supporting them are not predicted, it is reasonable to predict that indirect or secondary effects on the relevant bird species would also not be significant. Therefore, it is proposed that a reduction in prey availability as a result of the construction and decommissioning phases is scoped out of the assessment unless the Benthic and Intertidal Ecology and Fish and Shellfish Ecology assessments identify any significant impacts on seabird and shorebird prey species. Confidence that those sectoral assessments will not identify any significant impacts that will in turn affect birds comes from the fact that no ES submitted to date for an offshore wind farm in the North Sea has predicted a significant impact from this source on birds.

Indirect habitat loss (Operation and maintenance)

6.6.7.3 For the birds that have been identified as making use of the array area, there is the potential for indirect effects acting on them as a result of impacts upon their prey (primarily fish species) or on the habitats that support their prey. However, if significant effects on prey species or the habitats supporting them are not predicted, it is reasonable to predict that indirect or secondary effects on the relevant bird species would also not be significant. Therefore, it is proposed that a reduction in prey availability as a result of the operation of the array is scoped out of the assessment unless the Benthic and Intertidal Ecology and Fish and Shellfish Ecology assessments identify any significant impacts on seabird prey species. Confidence that those sectoral assessments will not identify any significant impacts on prey species that will in turn affect birds comes from the fact that no evidence of significant negative indirect or secondary impacts has been identified through the monitoring of offshore wind farm in the North Sea.

Disturbance / displacement offshore (Operation and maintenance)

6.6.7.4 For the birds that have been identified as making use of the offshore ECC, there is the potential for maintenance works on the cable to be a source of disturbance and potentially lead to displacement of birds from the area. It is proposed that disturbance / displacement of birds as a result of maintenance works on the cable is scoped out of the assessment because of the fact that such works would be limited both spatially and temporally.

Disturbance / displacement intertidal (Operation and maintenance)

6.6.7.5 For the birds that have been identified as making use of the intertidal zone of the offshore ECC landfall, there is the potential for maintenance works on the cable to be a source of disturbance and potentially lead to displacement of birds from the area. It is proposed that disturbance / displacement of birds as a result of maintenance works on the cable in

the intertidal zone is scoped out of the assessment because of the facts that such works would be limited both spatially and temporally and that no significant numbers of birds make use of the intertidal zone at the landfall.

6.6.8 Proposed Approach to the PEIR and ES

Overview

6.6.8.1 The next steps will be to progress the ornithological assessments considering the Scoping Opinion and ongoing discussions through the Evidence Plan process (see **section 5.6.5**) with key consultees from Natural England and the RSPB, the first of which meetings were conducted in September 2018. The following sections provide a high-level description of the proposed impact assessment methods that will be applied to offshore and intertidal ornithology receptors. The starting point for the definition of methods is the approach taken for Hornsea Project Three (Ørsted, 2018b). Those methods, including the definitions for the magnitude of impacts, importance / sensitivity of receptors and significance of potential effects, were subject to consultation and where methods were agreed that is recorded in the SoCG and Evidence Plan meeting minutes. These definitions are set out below.

Collision risk

6.6.8.2 It is considered that the most appropriate method to model the collision risk to seabirds is through the use of the Band (2012) CRM, with variations applied to account for variation around standard or mean values for a number of parameters.

6.6.8.3 In addition, two peer reviewed journal papers have been identified that provide new evidence for the use of revised parameters within CRM for calculating potential bird collision mortality rates. These include evidence supported new data on specific parameters such as the nocturnal activity rates (Furness, 2018) and avoidance rates (Cook et al., 2018) applied within the Band (2012) CRM, which are proposed for use in Hornsea Four collision risk assessments.

Displacement and disturbance

6.6.8.4 The starting point for the definition of methods to determine displacement rates (and ranges) and associated mortality rates (and ranges) is the approach taken for Hornsea Project Three (Ørsted, 2018b). These rates include the following for the four species assessed for disturbance and displacement in Hornsea Project Three (**Table 6-26**). It is proposed to apply the same rates to the Hornsea Four assessments

Table 6-26 – Hornsea Project Three Disturbance and Displacement Rates (to be applied to the Hornsea Four assessment)

Bio-season	Species	Gannet	Puffin	Razorbill	Guillemot
	Species-specific Displacement Level	30-70% Displacement	50% Displacement	40% Displacement	50% Displacement
Pre-breeding	Bio-season Mortality Rates	1%	n/a	2%	n/a
Breeding		2%	2-10%	2-10%	2-10%
Post-breeding		1%	n/a	2%	n/a
Non-breeding		n/a	1%	1%	1%

Species-specific biological seasons

6.6.8.5 Bird behaviour and abundance is recognised to differ across a calendar year dependent upon the season. Separate seasons will be recognised in the baseline technical reporting and impact assessments in order to establish the level of importance any seabird species has within the Hornsea Four array area plus 4 km buffer during any particular period of time. The biologically defined minimum population scales (BDMPS) bio-seasons are proposed to be based on those in Furness (2015), with amendments to accommodate site-specific circumstances being incorporated where evidence from the baseline data supports such use. For species not included in Furness (2015) bio-seasons will be agreed with Natural England through the Evidence Plan Process once identified.

Population modelling

6.6.8.6 A considerable amount of Population Viability Analysis (PVA) modelling was undertaken for seabirds assessed for the previous Hornsea projects. These models and their outputs will be utilised in the assessment of potential impacts for Hornsea Four.

6.6.9 Scoping Questions for Consultees

6.6.9.1 Scoping questions for consultees in relation to offshore and intertidal ornithology include:

1. Do you agree that the data sources identified are sufficient to inform the offshore and intertidal ornithological baseline for the Hornsea Four PEIR and ES?
2. Do you agree with the seabird data collection method i.e. 24 months of aerial survey of the Hornsea Four array area plus a 4 km buffer?
3. Do you agree that all potential impacts resulting from Hornsea Four been identified for offshore and intertidal ornithological receptors?
4. Do you agree with the proposed impact assessment criteria, including the definitions of magnitude, sensitivity and the significance of the effect?
5. Do you agree with the proposed approach to the assessment (impacts scoped in or out, and detailed or simple assessment) for each of the impacts in the Likely Significant Effects table?

6. Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the relevant potential effects of Hornsea Four on offshore and intertidal ornithological receptors?
7. Do you agree that those seabird species primarily identified as occurring in greatest numbers in the recent aerial surveys of the Hornsea Four array area and linked with nearby breeding colonies (SSSI, SPA & pSPA) and that may be potentially impacted by the construction and operation of the WTG array should form the focus of the ornithological assessment: Fulmar, gannet, great black-backed gull, herring gull, kittiwake, puffin, razorbill and guillemot?
8. Do you agree that, for the offshore ECC area, the species of interest in relation to the potential impacts of the construction (and maintenance) of the offshore cable and landfall is red-throated diver (which is known to be sensitive to vessel traffic and is an interest feature of the Greater Wash SPA)?
9. Do you agree that the following species can be scoped out of any further consideration in the impact assessment: Bird species occurring within the intertidal environment at, and around, the proposed landfall area?
10. For those impacts scoped in, and for the focus species identified, do you agree that the approach and methods described are sufficient to inform a robust impact assessment?
11. Are there any further means by which, beyond the embedded mitigation, the potential effects on the key seabird species present within the Hornsea Four array area could be reduced or avoided (for example, by avoiding areas of particularly high densities of the most at-risk species of birds)?

6.7 Marine Archaeology

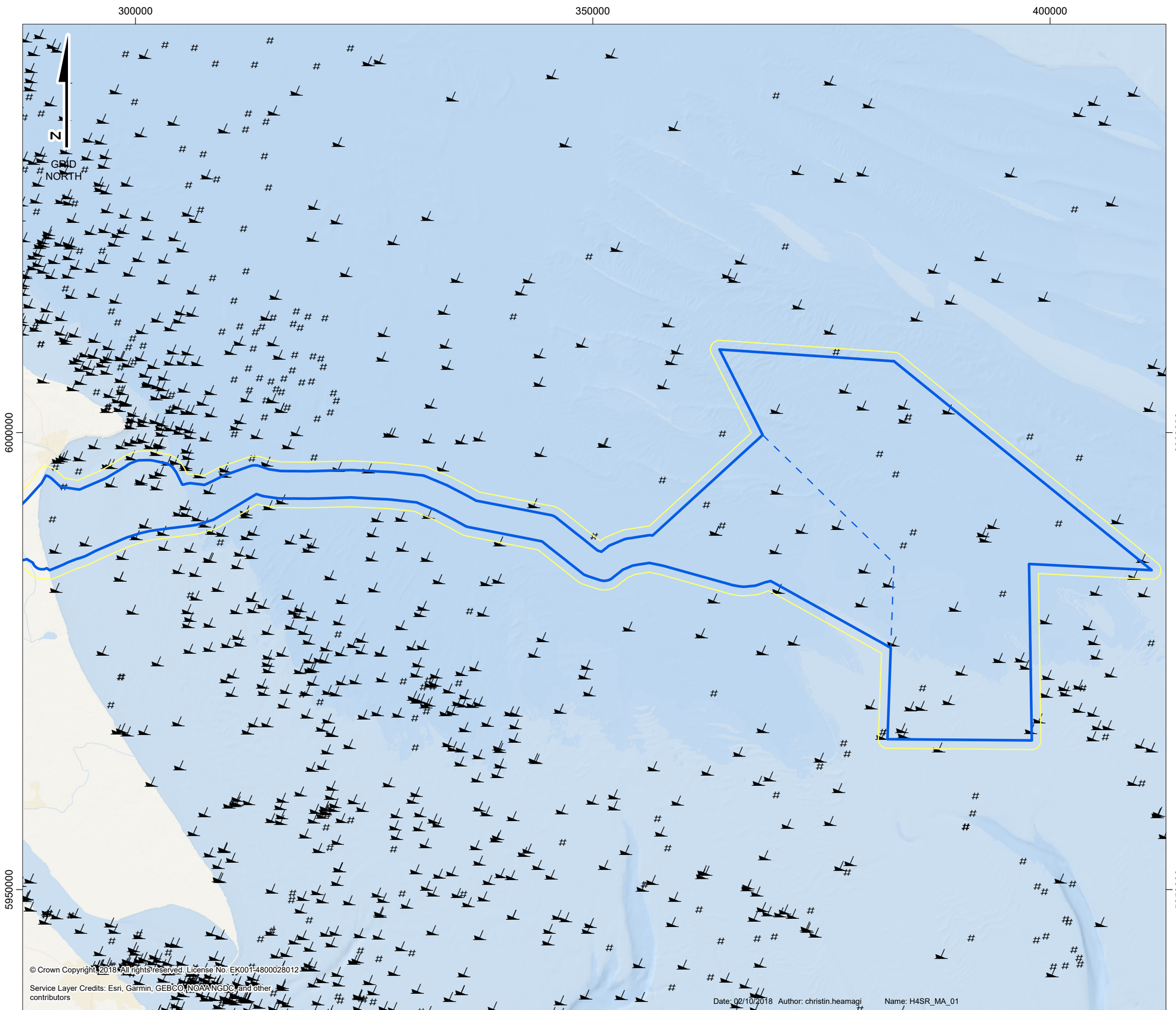
6.7.1 Introduction

6.7.1.1 This section of the Scoping Report identifies the cultural heritage assets of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components (i.e. seaward of MHWS) of Hornsea Four on cultural heritage assets.

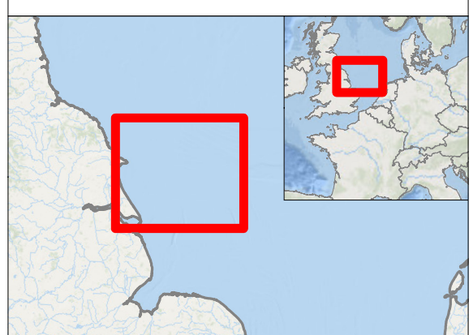
6.7.2 Study Area

6.7.2.1 A marine archaeology study area has been established for the purposes of collating baseline data as part of the desk-based study. The marine archaeology study area encompasses the Hornsea Four array area, including the intertidal zone seaward of MHWS, and the offshore ECC with a 1 km buffer, the boundaries of which define the zone where any potential effects on marine archaeology receptors may occur (**Figure 6-29**)

Hornsea Four
Marine Archaeology Study Area
Figure 6.29



- Scoping Boundary
- Array Area
- Obstruction
- Wreck
- 1km Study Area Buffer



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:400000

0 5 10 15 20 Kilometres

0 2 4 8 12 Nautical Miles

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Date: 02/10/2018 Author: christin.heamagi Name: H4SR_MA_01

Marine Archaeology Study Area
Document no: H4SR_MA_01
Created by: CH
Checked by: BM
Approved by: JS

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6.7.3 Baseline Environment

Data Sources Used for Scoping

6.7.3.1 The data sources detailed in **Table 7-11** were consulted to undertake an initial desk-based review of known cultural heritage assets and likely significant effects impacts. Site specific, desk-based assessment and the availability of geophysical and bathymetric data for Hornsea Four formed the primary basis of information reviewed for scoping.

Table 6-27 - Key sources of marine archaeology data for Hornsea Four

Source	Summary	Coverage of Hornsea Four array area and offshore ECC
National Record of the Historic Environment (NRHE)	Point data in relation to wrecks and palaeoenvironmental evidence via Archaeology Data Service (ADS) ArchSearch.	Full coverage of the Hornsea Four offshore ECC and array area.
UKHO wrecks and obstructions	Records of known wrecks and obstructions held by the United Kingdom Hydrographic Office (UKHO) and available via emapsite.com.	Full coverage of the Hornsea Four offshore ECC and array area.
UKHO Admiralty Charts	Admiralty charts and historic mapping relevant to the defined study area.	Full coverage of the Hornsea Four offshore ECC and array area.
Local Historic Environment Record office data	Point data derived from Historic Environment Records held by Humber HER.	Full coverage of the Hornsea Four offshore ECC and array area
North Sea Palaeolandscpaes Project (Gaffney et al., 2007)	Mesolithic landscape mapping of the North Sea.	Approximately 60% coverage of the offshore ECC and 40% coverage of the array area.
Humber Regional Environmental Characterisation (REC) (Tappin *et al.*, 2012)	Regional characterisation study incorporating side scan, sub-bottom and bathymetric data for the characterisation of the zone in terms of submerged landscape potential.	Study area located approximately 18 km south of the offshore ECC and 10 km south-east of the array area. Provides broadly comparative characterisation on a regional basis.
Technical report for Strategic Environmental Assessment (SEA) Area 3 (Flemming, 2003)	Description of palaeolandscape potential of the North Sea basin.	Broadscale data with regional coverage.
Hornsea One – Marine Archaeology Technical Report (2013)	Review of archaeological potential and reporting of geophysical and geoarchaeological interpretation of the subzone.	No coverage of Hornsea 4, though the detailed study provides useful characterisation of the directly adjacent subzone.
Hornsea One – Geoarchaeological Assessment (Stages 1 – 3) (2011 – 2018)	Detailed geoarchaeological assessments of boreholes and vibrocores obtained within the array and offshore ECC, including specialist analysis.	No coverage of Hornsea 4, though the detailed study provides useful characterisation of the directly adjacent subzone.
Hornsea Two – Marine Archaeology Technical Report (2015)	Review of archaeological potential and reporting of geophysical and geoarchaeological interpretation of the subzone.	No coverage of Hornsea 4, though the detailed study provides useful characterisation of the directly adjacent subzone.

Source	Summary	Coverage of Hornsea Four array area and offshore ECC
Hornsea Project Three – Marine Archaeology Technical Report (2018)	Review of archaeological potential and reporting of geophysical and geoarchaeological interpretation of the subzone.	No coverage of Hornsea 4, though the detailed study provides useful characterisation of the related subzone.

Overview of Baseline Environment

6.7.3.2 The offshore marine archaeological resource can be described in three main classes of material and features:

- Submerged prehistoric landscapes caused by changes to sea-level and eventual stabilisation of sea-level at or near to the present position. Such landscapes may contain highly significant evidence of prehistoric human occupation and/or environmental change;
- Archaeological remains of watercraft deposited when such vessels sank while at sea or became abandoned in an inter-tidal context which subsequently became inundated; and
- Remains of aircraft crash sites, either coherent assemblages or scattered material usually the result of Second World War (WWII) military conflict, but also numerous passenger casualties, particularly during the peak of seaplane activity during the inter-war period. Also, includes aircraft, airships and other dirigibles dating to the First World War (WWI) though these rarely survive in the archaeological record.

6.7.3.3 In addition, structural remains other than watercraft, including such elements as fish traps, abandoned quays, hards or defensive structures, may be found within the intertidal zone (between MHWS and MLWS). Marine archaeology receptors located seaward of MHWS have been considered in this section.

6.7.3.4 Submerged landscape potential within the study area is high. While the array area is partially located within a data gap in the interpretation presented in the North Sea Palaeolandscape Project, it can be expected that the mapped Mesolithic shoreline would track inside the north-eastern array area boundary. This would have been the former shoreline following the end of the last glaciation (c. 10,000 Before Present (BP)), prior to the inundation of the landscape to a fully marine environment around 5,500 BP (Gaffney et al., 2007 – **Figure 6-30**).

Hornsea Four
Early Holocene landscape
Figure 6.30

250000 300000 350000 400000 450000 500000

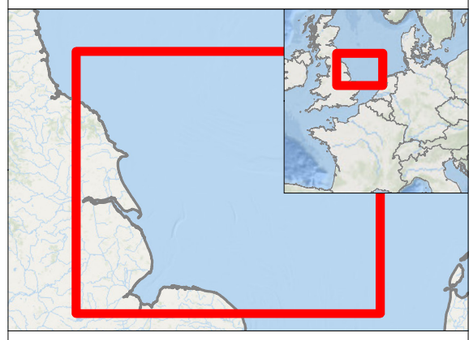
6100000 6050000 6000000 5950000 5900000 5850000

N
GRID NORTH

- Scoping Boundary
- Array Area
- Lake
- Fluvial Deposit
- Early Holocene Shoreline

Topography Relative to Early Holocene Sea Level

- High
- Inter. Low
- Low
- Mod/High
- Moderate
- Moderate Low
- V.Low



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:950000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Data source: https://doi.org/10.5284/1000397

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Date: 02/10/2018 Author: christin.heamagi Name: H4SR_MA_02

Early Holocene landscape
Document no: H4SR_MA_02
Created by: CH
Checked by: BM
Approved by: JS

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6.7.3.5 Earlier fluctuations in sea-level and temperature also presented opportunities for hominin exploitation of the landscape and from which sites, features and finds may remain preserved. These periods are associated with the retreat of ice-sheets following the last three glacial maximums:

- Devensian: Upper Palaeolithic c. 100 – 22,000 BP (glacial maximum);
- Wolstonian: Lower Palaeolithic c. 250 – 150,000 BP (glacial maximum); and
- Anglian: Lower Palaeolithic c. 350 – 280,000 BP (glacial maximum).

6.7.3.6 Due to the effects of scouring of this part of the North Sea basin by ice during each successive glacial period, the potential for material from the Palaeolithic is highest within the last 100,000 years and increases significantly following the last glacial maximum (Flemming, 2002).

6.7.3.7 There are no in-situ finds from the region, although the potential for the preservation of such material is well attested in similar contexts based on finds from developments such as aggregate dredging Area 240 off the coast of Norfolk (Tizzard et al., 2014) where an assemblage of Middle Palaeolithic tools has been recovered.

6.7.3.8 The highest area of potential within the study area is the former Mesolithic shoreline that is associated with the Outer Silver Pit in the northern part of the offshore array area. The remainder of the Hornsea Four array area and the offshore ECC crosses areas mapped as harder geology intersected by fluvial systems, which may also have provided a focus for human exploitation of natural resources (Gaffney et al., 2007, **Figure 6-31**).

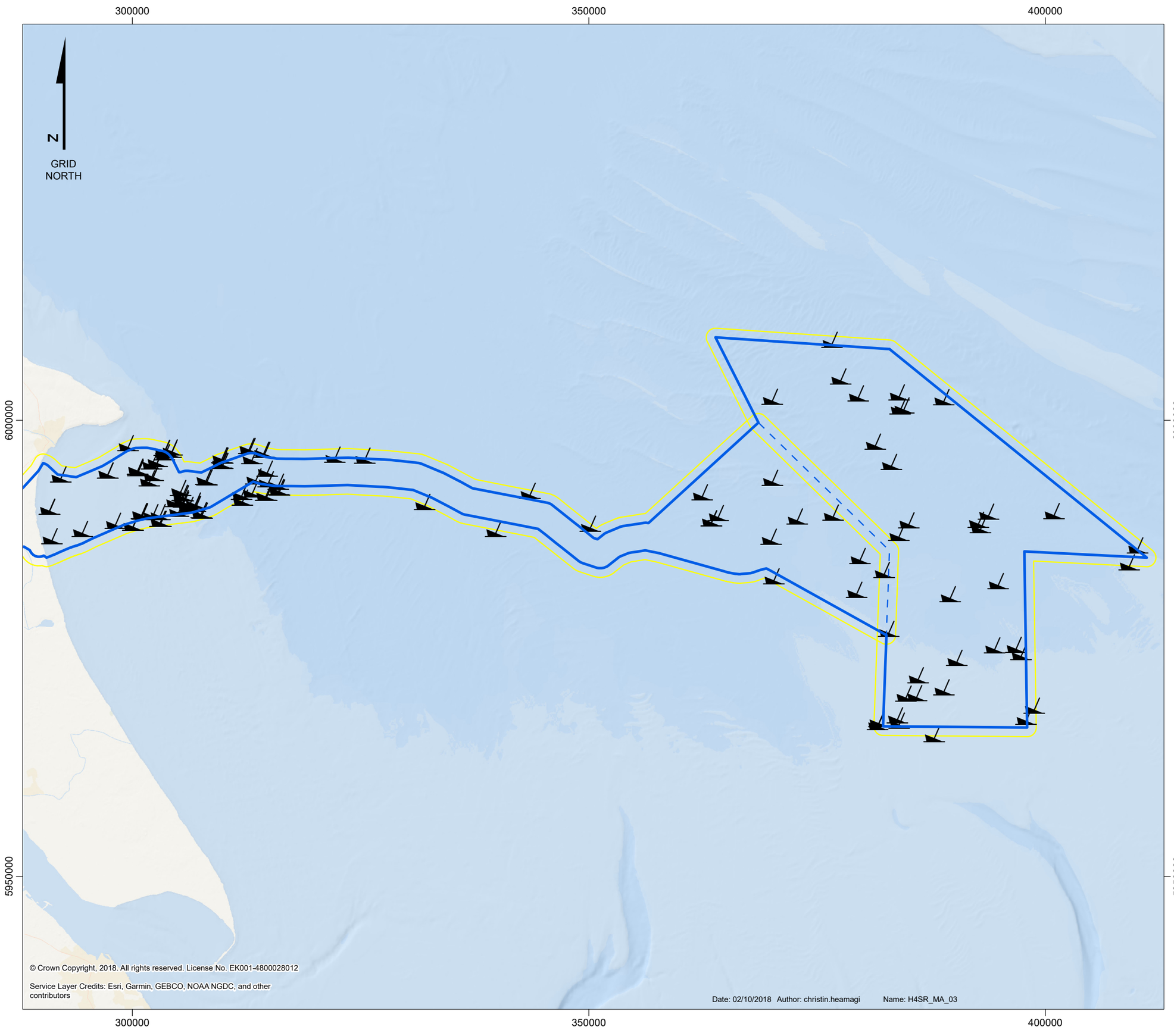
6.7.3.9 There are no protected areas or statutory designations in relation to submerged landscapes within the study area.

6.7.3.10 While water depths across the study area range from MHWS to a depth of 65 m lowest astronomical tide (LAT) in the north-eastern part of the Hornsea Four array area, the frequency of recorded wreck sites increases in closer proximity to the shore, with 57% located with the offshore ECC and 1 km buffer.

6.7.3.11 There are 84 known wrecks and obstructions recorded by the UKHO within the study area including the Hornsea Four array area, 13 of which are listed as obstructions. Thirty-six lie within the array area, while 48 are located within the offshore ECC (**Figure 6-31**).

6.7.3.12 Seventeen additional unique records were contained in data search results from the National Record of the Historic Environment (NRHE). One record (HMS Falcon (stern section)) is recorded as being located directly on the offshore ECC in the NRHE data set. Following a comparative assessment of available data sources, including the reliably surveyed UKHO position and Admiralty Charts, the NRHE position has been rejected and has been removed from the dataset. This wreck is considered to be located 3.8 km south of the study area.

Hornsea Four
Marine Archaeology Receptors
Figure 6.31



Marine Archaeology Receptors
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6.7.3.13 Of the currently identified wrecks, the majority relate to steamship transport casualties from the First World War, with even numbers of 19th century, WWII and also post-1950 wrecks foundered as recently as 2002, as shown in Table 6-28.

Table 6-28 – Known Wrecks located within the Study Area by Period.

Period	Number recorded	Types
19th century	6	Ketch, steamships
WWI	15	Trawlers, steamships, submarine
WWII	2	Trawlers
Post-WWII (1946 – present)	10	Trawlers, fishing vessel
Unknown date	67	Anchor, lost cargo, lost equipment, obstructions / foul

Summary and Key Issues

6.7.3.14 While there remains the potential to encounter watercraft from all periods, as well as aircraft, within the study area, the known wrecks and obstructions identified through scoping are confined to the last 150 years.

6.7.3.15 These features have been considered during the route planning of the offshore ECC, and, though final turbine locations are not yet determined, this form of embedded mitigation (avoidance) will also be applied to the array area, as described below.

6.7.3.16 A such, there are no designated sites with statutory protection under the Protection of Wrecks Act 1973 or the Archaeological Monuments and Ancient Areas Act 1979, which are the principal statutory instruments for the legislated protection of significant marine archaeological sites within UK waters.

6.7.3.17 There are no known aircraft losses within the project study area. However, should any remains of military aircraft be discovered, they will be automatically protected under the Protection of Military Remains Act 1986.

6.7.3.18 Ørsted are developing a streamlined approach to the EIA for Hornsea Project Four with an aim to delivering a proportionate EIA in line with current Institute of Environmental Management and Assessment (IEMA) guidance and best-practice. The proposed limited survey coverage in the pre-application stage is consistent with this proportionate approach which prioritises the collection of data at milestones where it will be most valuable for the development of the project. It is important to note that data will be collected to cover 100% of areas within which construction works will take place, but in the pre-construction phase as opposed to the pre-application phase. This will allow for the most up-to-date data to be provided for archaeological review prior to construction and which will be used to identify archaeological receptors with a high degree of confidence, as opposed to relying on data collected over five years before the point of construction.

6.7.3.19 Within the Hornsea Four array area, the orientation of the geophysical survey gridlines (as shown in Figure 6-32) have been designed to match the agreed lines of orientation of WTGs for Hornsea Project Two and therefore most likely represent the proposed lines of orientation for Hornsea Four. The spacing of these survey gridlines range between 715 m

and 1,440 m, with crosslines at 3,000 m intervals. This survey is not expected to achieve full coverage of the array site, but rather to provide corridors of data along the run lines.

6.7.3.20 Along the proposed offshore ECC which is currently 3 km wide, the intention is to generate a line plan of seven main lines at approximately 525 m line spacing running the length of the corridor. Additionally, cross lines will be run at approximately 5 km intervals. As is the case for the Hornsea Four array area, this survey is not intended to provide full data coverage within the corridor but will provide a swath of data centred around each of the run lines.

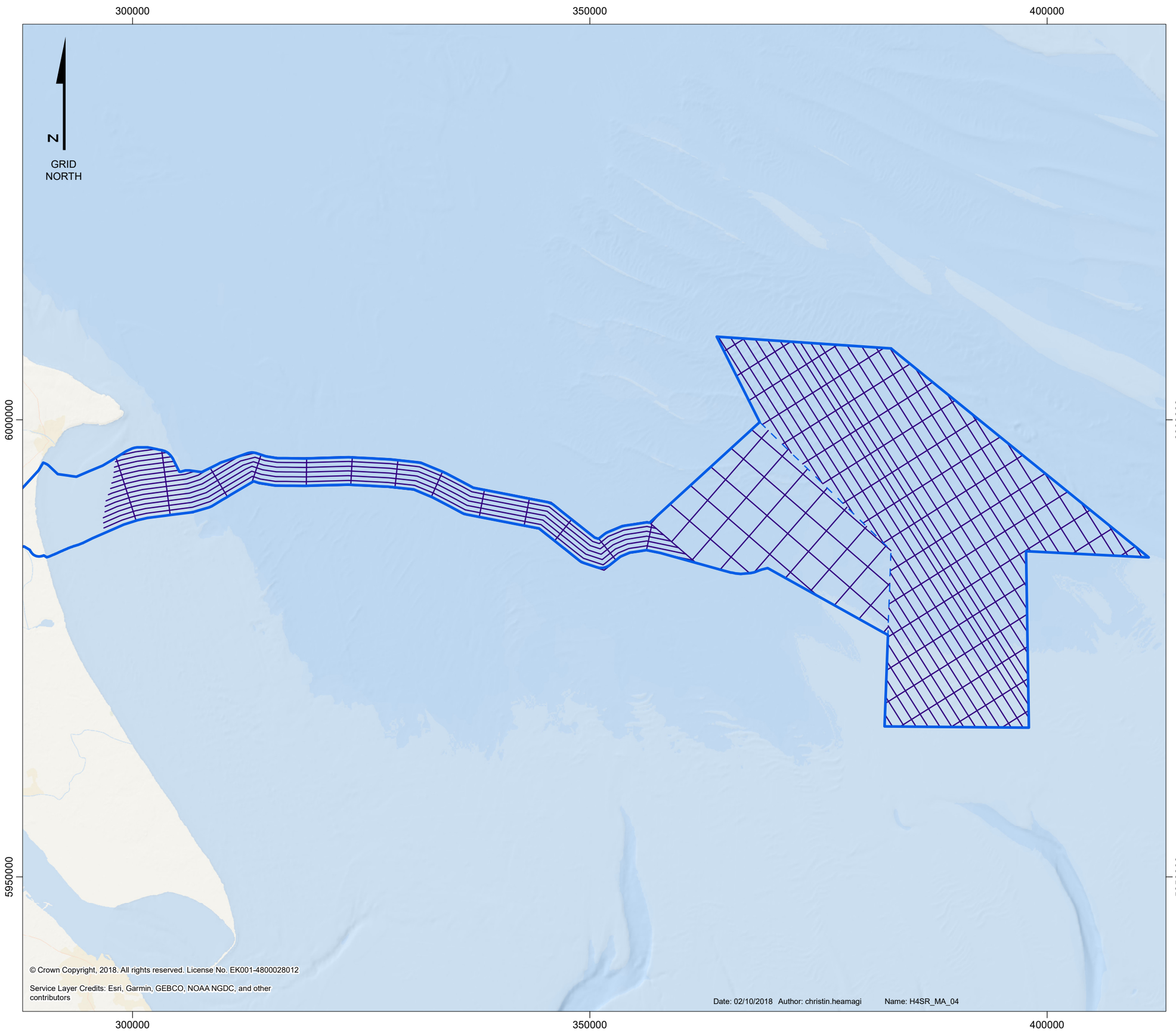
6.7.3.21 The offshore ECC fans out where it meets the Hornsea Four array area. Within this fan area, data will be logged at an approximately 3,000m x 3,000m grid line interval. The offshore ECC also fans out towards the landfall with full geophysical survey coverage (<50 m line spacing) planned for the area inshore of the 10m LAT contour.

6.7.3.22 A full coverage, pre-application, geophysical survey will be undertaken in 2019 or 2020 for the area proposed to be taken forward for development and hence assessed in the ES. This survey will provide full coverage of the areas that will form the Order limits within the DCO application.

6.7.3.23 As is typically mandated for offshore wind farm projects, the dMLs for Hornsea Four will include the requirement to conduct a high-resolution swath bathymetric survey to include 100% coverage for the parts of Order limits within which it is proposed to carry out construction works and disposal activities, including an appropriate buffer around the site of each works. Hornsea Four will also commit to the review of high-resolution magnetometer and side scan sonar at this time, collected to a specification suitable for UXO identification, which will also form a requirement under the dML(s).

6.7.3.24 Copies of all available geophysical data will be made available for full archaeological review prior to the commencement of construction works.

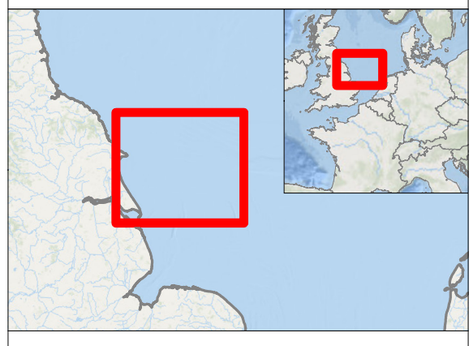
Hornsea Four
Geophysical Survey Lines
Figure 6.32



Scoping Boundary

Array Area

Survey Lines



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:400000

0 5 10 15 20 Kilometres

0 2 4 8 12 Nautical Miles

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Geophysical Survey Lines
Document no: H4SR_MA_04
Created by: CH
Checked by: BM
Approved by: JS

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6.7.4 Project Basis for Scoping Assessment

6.7.4.1 The basis for the scoping assessment for marine archaeology is based on the project description presented in **Section 3** Project Description, which sets out the footprint and the maximum design scenario for the project:

- the construction of up to 180 WTGs on gravity base structure foundations with associated seabed preparation and scour protection;
- the construction of up to ten offshore substations, platforms, and accommodation platforms within the array area, and up to three HVAC booster stations along the offshore ECC, all on gravity base structure foundations with associated seabed preparation and scour protection; and
- the construction of offshore export cables, inter-array cables and interconnector cables and associated cable protection.

6.7.4.2 The basis for the assessment also includes the embedded mitigation (detailed in **section 6.7.5** below) where appropriate.

6.7.5 Embedded Mitigation

6.7.5.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed to reduce the potential for impacts on marine archaeology receptors. These are presented in **Table 6-29**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

6.7.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures (Tertiary), they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section 6.7.6** below (i.e. the determination of magnitude of impact and significance of effect assumes implementation of these measures).

6.7.5.3 For the development of primary and secondary mitigation, data from geophysical surveys undertaken in 2011 is available for review by Hornsea Four, which covers approximately one third of the Hornsea Four array area in the south-eastern extent.

6.7.5.4 Tertiary mitigation will be implemented through the development of an outline archaeological Written Scheme of Investigation (WSI) for Hornsea Four, developed according to current best-practice guidelines, including:

- *Historic Environment Guidance for the Offshore Renewable Energy Sector (COWRIE, 2007);*
- *Marine Geophysics Data Acquisition, Processing and Interpretation (Historic England, 2013);*
- *Model Clauses for Written Schemes of Investigation (The Crown Estate, 2010);*
- *Offshore Geotechnical Investigation and Historic Environment Analysis: Guidance for the Renewable Energy Sector (COWRIE, 2011).*

6.7.5.5 The WSI will also include the development and implementation of a Protocol for Archaeological Discoveries in accordance with 'Protocol for Archaeological Discoveries: Offshore Renewables Projects' (The Crown Estate, 2014).

Table 6-29 – Relevant Marine Archaeology Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co46	Primary: All offshore infrastructure will be routed/located so as to avoid any known wrecks (with a buffer of 50m around wreck).	Secured in the dMLs through the requirement for a Design Plan.
Co140	Secondary: Establishment of archaeological exclusion zones (AEZs) as required to protect any known / identified marine archaeological receptors.	Secured in the dMLs through the requirement for a Written Scheme of Archaeological Investigation (WSI).
Co141	Tertiary: Development and agreement of an archaeological WSI, including the development and implementation of a Protocol for Archaeological Discoveries in accordance with 'Protocol for Archaeological Discoveries: Offshore Renewables Projects' (The Crown Estate, 2014).	Secured in the dMLs through the requirement for a Written Scheme of Archaeological Investigation (WSI).
Co142	Tertiary: A programme of geoarchaeological assessment and analysis will be undertaken on geotechnical samples collected across the offshore ECC and array area, which will include early engagement with the geoarchaeologist to optimise sample locations and will result in the delivery of a paleogeographic ground-model.	Programme of geoarchaeological assessment and analysis to be agreed via the Evidence Plan process.

6.7.6 Likely Significant Effects

6.7.6.1 Table 6-30 sets out an assessment of effects on marine archaeology at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.7.6.2 The assessment presented in Table 6-30 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 6-30 together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for marine archaeology effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified marine archaeologists.

6.7.6.3 Table 6-30 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.7.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

6.7.6.5 The determination of the impacts that are scoped into or out of assessment has been based on a combination of factors, including the results of the marine archaeology impact assessment for previous Hornsea Projects and the expert judgement of Maritime Archaeology based on involvement in numerous previous impact assessments for offshore wind developments of a similar scale in the UK.

6.7.6.6 The significance of impacts at Hornsea Four are likely to be analogous to those assessed at the previous Hornsea Projects and other Round 3 offshore wind farm developments that are of a similar scale and located in comparable offshore heritage landscapes. Thus, it was possible to identify impact pathways that would likely have no significant impact on marine archaeology and cultural heritage and which could be scoped out of assessment for Hornsea Four. The following sections detail which impact pathways have been scoped into and out of assessment, with detailed justifications provided for the impacts that have been scoped out of assessment.

6.7.6.7 The following impact pathways have been identified as requiring a simple approach to assessment:

- Scour effects: operation phase; and
- Draw-down of sediment: voids (decommissioning).

Table 6-30 - Likely Effects - Marine Archaeology

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction phase: Removal of sediment containing undisturbed archaeological contexts leading to total loss of the receptor during preparation of the seabed for WTG and offshore substation foundations.	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Very High	**No likely significant effect**	**Scoped out**	Review of the site-specific geophysical survey data providing 100% coverage of Hornsea Four; archaeological assessment of geotechnical data.
Construction phase: Intrusion of piling foundations disturbing or destroying archaeological receptors.	Primary Co46 Secondary Co140 Tertiary Co141 Co142	Negligible	Very High	**No likely significant effect**	**Scoped out**	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Construction phase: Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and wind turbine.	Primary Co46 Secondary Co140 Tertiary Co141 Co142	Negligible	Very High	**No likely significant effect**	**Scoped Out**	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Construction phase: Disturbance of sediment containing potential archaeological receptors (material and contexts) during inter-array cable laying operations.	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Very High	**No likely significant effect**	**Scoped Out**	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
						assessment of geotechnical data
Construction phase: Disturbance of sediment containing potential archaeological receptors (material and contexts) during export cable laying operations.	Primary Co46 Secondary Co140) Tertiary Co141, Co142	Negligible	Very High	**No likely significant effect**	**Scoped Out**	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Construction phase: Penetration and compression effects of jack-up barges and anchoring of construction vessels during turbine, sub-station or cable installation leading to total or partial loss of archaeological receptors (material or contexts).	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Very High.	**No likely significant effect**	**Scoped Out**	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Operation phase: Scour effects caused by (a) the presence of WTG substation foundations, and (b) the exposure of inter-array and export cables or the use of cable protection measures, impacting archaeological receptors and exposing such material to natural, chemical or biological processes and causing or accelerating loss of the same.	Primary Co46 Secondary Co140 Tertiary Co141 Co142	Moderate	Very High	**Likely significant effect without secondary mitigation** Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position and extent of the marine archaeological resources at Hornsea Four not yet established.	Scoped In A simple assessment approach will be adopted involving review of geophysical survey data, identification of features of value to feed into location-specific AEZ development for avoidance.	Review of geophysical survey data providing coverage for the purposes of monitoring during operation with 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data; Marine Processes input to determine extent of scour effects.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operation phase: Penetration and compression effects on seabed caused by corrective and preventative operation and maintenance activities (via jack-up vessels) leading to total or partial loss of archaeological receptors (material or contexts).	Primary Co46 Secondary Co140 Tertiary Co141 Co142	Moderate	Very High	**Likely significant effect without secondary mitigation** Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position and extent of the marine archaeological resources at Hornsea Four not yet established.	Scoped In A simple assessment approach will be adopted involving review of geophysical survey data, identification of features of value to feed into location-specific AEZ development for avoidance.	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Decommissioning phase: Draw-down of sediment into voids left by removed turbine foundations leading to loss of sediment, destabilising archaeological sites and contexts, and exposing such material to natural, chemical or biological processes, and causing or accelerating loss of the same.	Primary Co46 Secondary Co140) Tertiary Co141 Co142	Moderate	Very High	**Likely significant effect without secondary mitigation** Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position and extent of the marine archaeological resources at Hornsea Four not yet established.	Scoped In A simple assessment approach will be adopted involving review of geophysical survey data, identification of features of value to feed into location-specific AEZ development for avoidance.	Review of geophysical survey data providing coverage for the purposes of monitoring during operation with 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data; Marine Processes input to determine extent of scour effects.
Decommissioning phase: Penetration and compression effects of jack-up barges and anchoring of decommissioning vessels leading to total or partial loss of archaeological receptors (material or contexts).	Primary Co46 Secondary Co140 Tertiary Co141 Co142	Negligible	Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position	**No likely significant effect**	**Scoped Out**	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
			and extent of the marine archaeological resources at Hornsea Four not yet established.			

6.7.7 Impacts Scoped Out of Assessment

6.7.7.1 The following sections detail the impact pathways that were scoped out of assessment.

- (Construction) Removal of sediment containing undisturbed archaeological contexts leading to total loss of the receptor during preparation of the seabed for WTG and offshore substation foundations;
- (Construction) Intrusion of piling foundations disturbing or destroying archaeological receptors;
- (Construction and operation) Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and wind turbine;
- (Construction) Disturbance of sediment containing potential archaeological receptors (material and contexts) during inter-array cable laying operations;
- (Construction) Disturbance of sediment containing potential archaeological receptors (material and contexts) during export cable laying operations;
- (Construction and decommissioning) Penetration and compression effects of jack-up barges and anchoring of vessels during turbine, sub-station or cable installation and removal leading to total or partial loss of archaeological receptors (material or contexts);

6.7.7.2 Although the potential magnitude of impact is high and all marine archaeological receptors are of high significance in the worst case, the embedded mitigation adopted for the project forms a commitment to avoid all identified archaeological receptors of medium or high significance or medium or high archaeological potential. Through the adoption of AEZs of an appropriate size and extent the embedded mitigation (primary and tertiary) will ensure that project design is micro-sited to the effect that direct impacts on marine archaeological receptors, as listed above, will not occur.

6.7.7.3 This approach is supported by evidence from the adjacent Hornsea Projects where impacts following mitigation were reduced to minor, negligible or none, which is not significant in EIA terms. The same results are found across similar Round 3 offshore wind farm projects.

6.7.7.4 Tertiary mitigation in the form of an archaeological WSI and project specific reporting protocol for unexpected discoveries will ensure that mitigation is managed effectively post-consent. The implementation of a WSI, agreed with Historic England, will form a commitment in the dML(s).

6.7.8 Proposed Approach to the PEIR and ES

6.7.8.1 A full desk-based study will seek to determine the marine archaeological potential of the development area and the wider marine archaeology study area and the importance of marine archaeology receptors, both known and as yet unknown. This will be achieved through the characterisation of known cultural heritage to highlight the likely importance of any unknown receptors that may be encountered, primarily during the construction phase of Hornsea Four.

6.7.8.2 Consultation with statutory advisors (HE and ERYC) and regular engagement will be established through the evidence plan process to ensure that the assessment proceeds according to the regulators' requirements.

6.7.8.3 Secondary mitigation will constitute a full review of available marine geophysical survey data. This review will identify marine archaeological receptors and will assign a rating of archaeological potential. This will be based on a limited coverage survey during the application phase, with 100% coverage of the final design plan reviewed prior to construction.

6.7.8.4 Assessment of significance of effects will consider all aspects of the maximum design scenario to determine likely effects on all marine archaeological receptors, both known and potential, identified during the detailed desk-based studies outlined above.

6.7.8.5 Primary and secondary mitigation will be developed based on the principles of avoidance as described in Model Clauses for Written Schemes of Investigation (The Crown Estate, 2010) and established industry best-practice. For discrete archaeological features this will be based primarily on avoidance.

6.7.8.6 Tertiary mitigation will be delivered through an outline archaeological WSI that will be developed to detail all marine archaeology mitigation commitments, and which will outline specific packages of work required to meet those commitments. The WSI will describe the roles and responsibilities of the applicant, statutory advisers and archaeological contractors, and set out the requirements for further surveys and monitoring to deliver all mitigation requirements.

6.7.8.7 In tandem with the WSI, a Protocol for Archaeological Discoveries will be developed that will ensure the awareness of all managers and contractors undertaking offshore work at Hornsea Four, prior to or during construction, and throughout operational and decommissioning phases.

6.7.9 Scoping Questions for Consultees

6.7.9.1 Scoping questions for consultees in relation to marine archaeology include:

1. Do you agree that all of the known marine archaeological receptors within the zone of influence have been identified and considered?
2. Do you agree that all relevant sources of secondary data have been accessed for scoping or identified for use in the EIA?
3. Do you agree that analysis of limited geophysical data swaths provides a sound basis for the purposes of characterisation of marine archaeology and the establishment of the range of likely significant affects, given that full analysis of specific impacts will be under-taken post-consent through full archaeological review?
4. Is there any other baseline information that you feel should be considered?

6.8 Commercial Fisheries

6.8.1 Introduction

6.8.1.1 This section of the Scoping Report identifies the commercial fisheries receptors of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components (i.e. seaward of MHWS) of Hornsea Four on commercial fisheries.

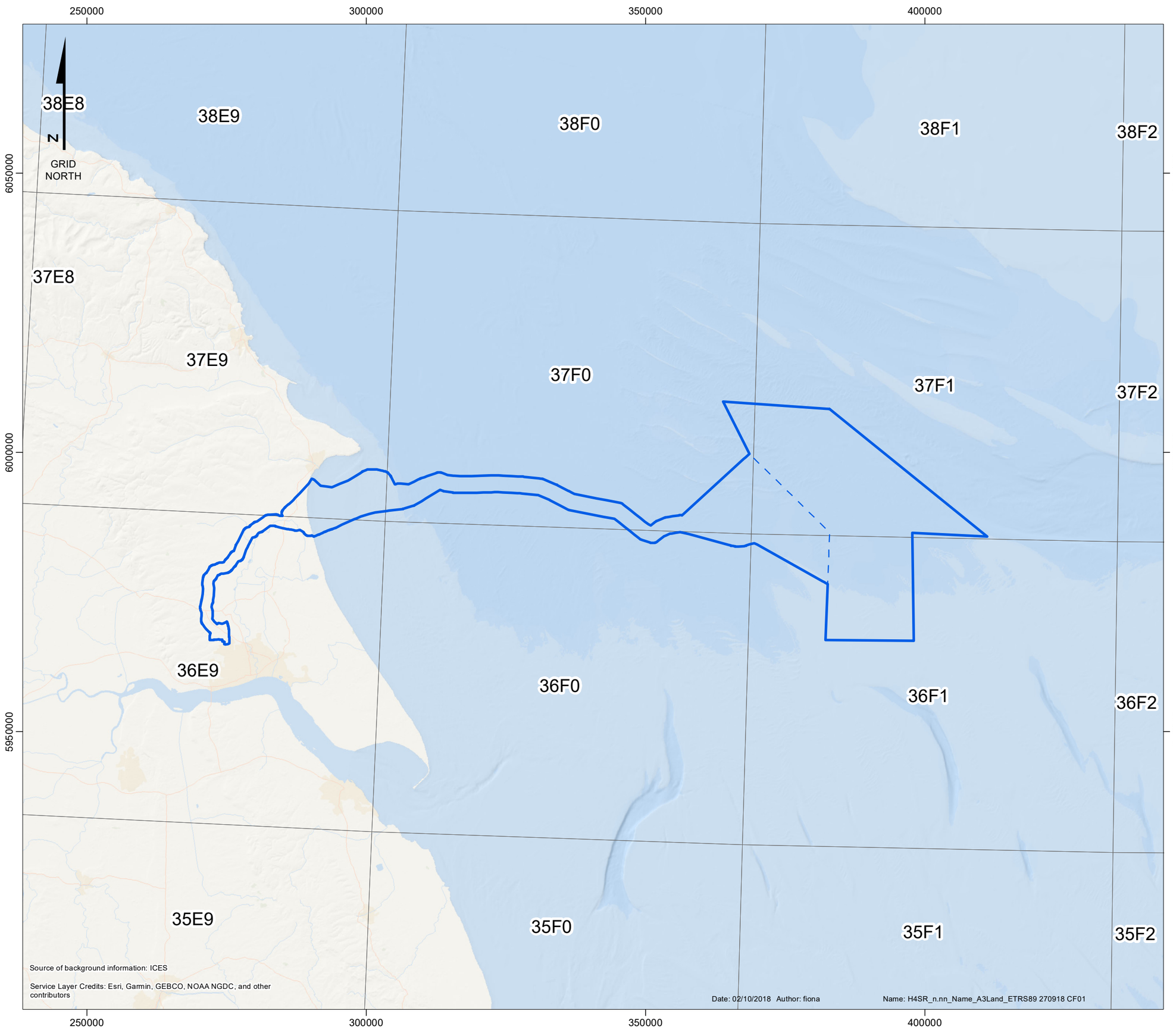
6.8.2 Study Area

6.8.2.1 The proposed Hornsea Four array area is located within the southwest portion of the International Council for the Exploration of the Sea (ICES) Division 4b (Central North Sea) statistical area[6]; outside the 12 NM limit in UK Exclusive Economic Zone (EEZ) waters. For the purpose of recording fisheries landings, ICES Division 4b is divided into statistical rectangles which are consistent across all Member States operating in the North Sea.

6.8.2.2 For the purposes of this scoping exercise, the Hornsea Four commercial fisheries study area comprises six ICES rectangles (ICES Rectangles 37E9 to 37F1 and 36E9 to 36F1), within which the array area (ICES rectangles 37F0, 37F1, and 36F1) and offshore ECC (ICES rectangles 37E9, 37F0, 37F1, 36F1, 36F0, and 36E9) are located. The study area is shown in **Figure 6-33**.

[6] ICES standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is '30 min latitude by 1 degree longitude' in size (approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES staistical areas

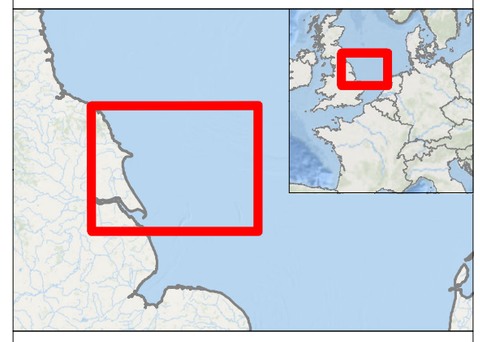
Hornsea Four
ICES statistical rectangles
Figure 6.33



Scoping Boundary

Array Area

ICES Statistical Rectangles



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:653250

0 4 8 16 24 32 Kilometres

0 2 4 8 12 Nautical Miles

ICES statistical rectangles
Document no: H4SR_CF01
Created by: FN
Checked by: SM
Approved by: LK

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6.8.3 Baseline Environment

Data Sources used for Scoping

6.8.3.1 An initial desk-based review of literature and data sources was undertaken to support this scoping exercise, as presented in **Table 6-31** below.

Table 6-31 - Key Sources of Commercial Fisheries Data

Source	Summary	Coverage of Hornsea Four development area
Landings Statistics, for the five-year period 2012 – 2016. Sourced from the Marine Management Organisation (MMO) and the European Union Data Collection Framework (EU DCF).	Fisheries landings data for nationally registered fishing vessels landing to their home nation ports.	Full coverage of the Hornsea Four development area.
Vessel Monitoring System (VMS) data, for the five-year period 2012 – 2016. Sourced from the MMO.	Fisheries effort and landings data for fishing vessels greater than 15 m in length.	Full coverage of the Hornsea Four development area.
Overview of the Dutch fishing activities on the Hornsea area: Trends in effort, landings and landings value for 2011-2015. Sourced from Oostenbrugge, van, H.J.A.E., and Hamon, K.G. (2017), Wageningen Economic Research.	Overview of activity by Dutch-registered fishing vessels in the Hornsea Project Three development area.	Partial coverage of the Hornsea Four array area.
Maps of key sandeel grounds based on vessel tracking plots from Danish registered vessels from 1985 to 2010. Sourced from the Danish Fishermen's Association (2011).	Maps of known sandeel grounds utilised by Danish-registered fishing vessels.	Full coverage of the Hornsea Four development area.
Data derived from geophysical fisheries reconnaissance survey	Data gathered in advance of site specific geophysical surveys.	Full coverage of the Hornsea Four development area.

6.8.3.2 It should be noted that the above quantitative datasets do not capture all fishing activity in the commercial fisheries study area. For instance, it should also be noted that the VMS dataset only covers vessels larger than 15 m. However, other published data does provide a useful insight into fishing activity undertaken in inshore areas (e.g. including a number of North Eastern Inshore Fisheries and Conservation Authority (IFCA) publications and statistics). In addition, it is known that some fisheries (e.g. sandeel and scallop) exhibit long-term fluctuations in effort and landings and in their spatial distribution, which may not be captured by the time period of the datasets described above; to understand commercial fisheries activity in the study area associated with these fisheries, analysis of longer-term datasets is proposed as part of the Environmental Impact Assessment (EIA).

Overview of Baseline Environment

6.8.3.3 The Hornsea Four commercial fisheries study area lies within OSPAR Region 2 – Greater North Sea. The Hornsea Four array area and offshore ECC overlaps ICES rectangles 37E9, 37F0, 37F1, 36E9, 36F0 and 36F1, which have an annual average value of £19.69 million for all UK vessels for the years 2012 to 2016 (MMO, 2017). The value of foreign vessel landings is not accounted for in this total, though the value of landings of key species targeted by foreign vessels is discussed immediately below. It is important to note that the Hornsea Four array area and offshore ECC occupies only a portion of these ICES rectangles (8.83%).

6.8.3.4 For non-UK vessels, the commercial fisheries study area is dominated by landings of herring *Clupea harengus* by Dutch and German vessels in particular (**Figure 6-34**), and of sandeels *Ammodytes marinus*, predominantly by Danish vessels (**Figure 6-35**)). The significant landings are reflective of the industrial scale of these fisheries. The average annual value of herring landings over the five-year study period is in excess of approximately £5.67 million, and for sandeel landings the equivalent value is approximately £1.75 million. Data shows notable fluctuations in annual landings for both species, indicative of the opportunistic nature of the fisheries. Herring, caught mainly by pelagic trawl, are primarily landed from ICES rectangle 37F0, which overlaps with the offshore ECC and a small portion of the array area. Highly mobile pelagic species, that move in shoals and are not associated with specific seabed habitats, are assumed to be available to catch across large areas i.e., if a shoal of herring cannot be caught within Hornsea Four array area or offshore ECC, this shoal is expected to move to an area where they can be caught.

6.8.3.5 Sandeels, caught mainly by otter trawl, are primarily landed from ICES rectangle 37FI, which overlaps with a large portion of the array area and the offshore ECC to a lesser extent. North Sea sandeel grounds are well-mapped, and data indicates that whilst the array area does partially overlap with some grounds, the majority of grounds within ICES rectangle 37F1 are to the north of the array area (based on sandeel fishing tracks, provided by the Danish Fishermen's Association).

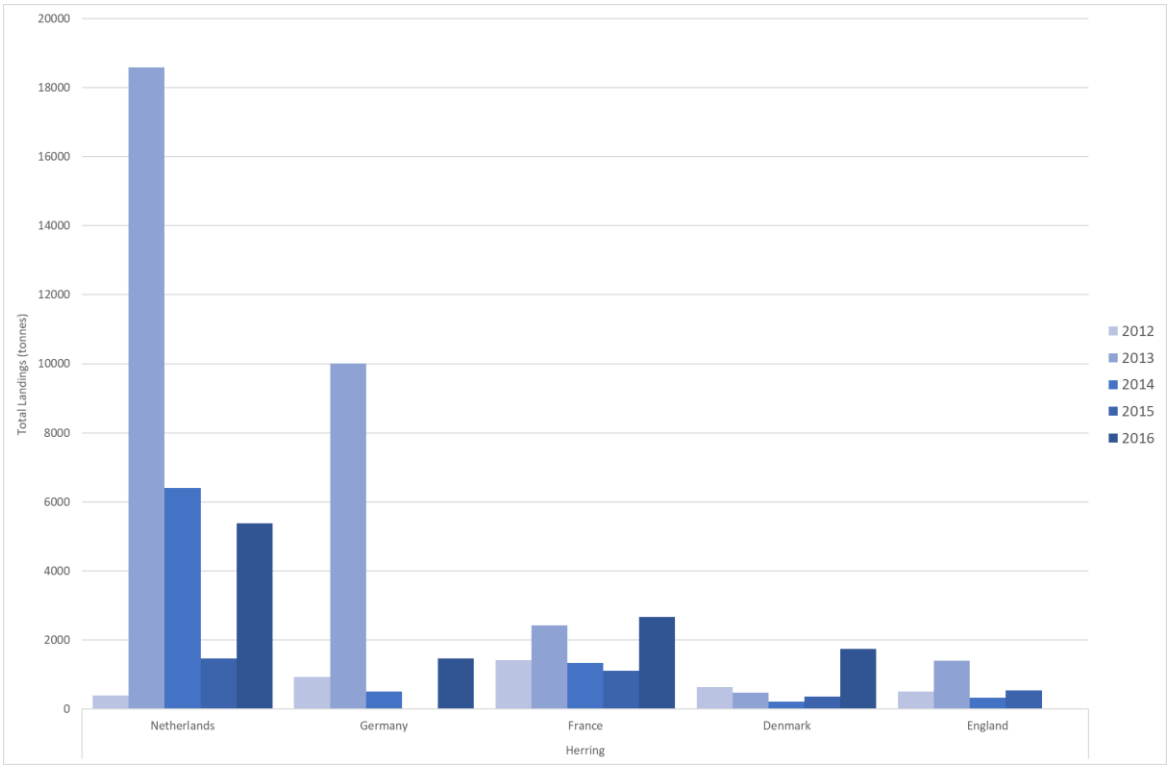


Figure 6-34 - Total volume (tonnes) of landings of herring from 2012 to 2016 from the Hornsea Four commercial fisheries study area by vessel registered nationality (EU DCF, 2018).

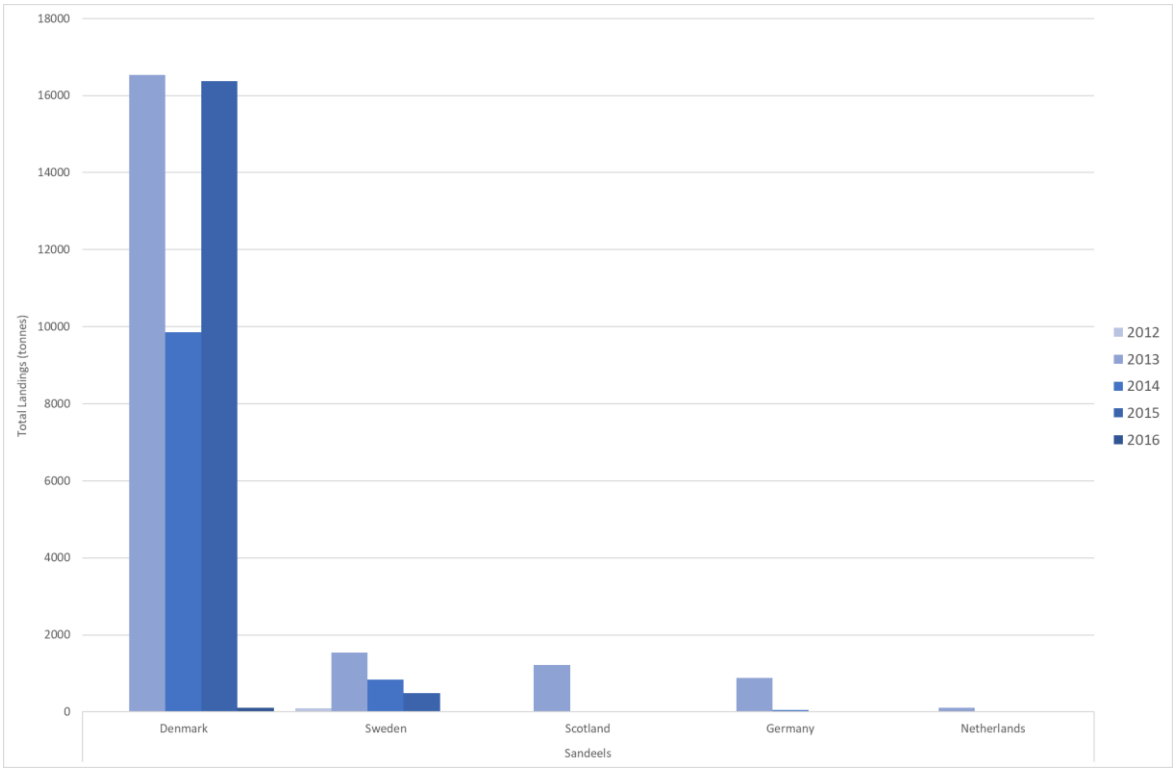


Figure 6-35 - Total volume (tonnes) of landings of sandeels from 2012 to 2016 from the Hornsea Four commercial fisheries study area by vessel registered nationality (EU DCF, 2018).

6.8.3.6 Excluding herring and sandeel fisheries, Figure 6-36 shows the top twelve species landed from the entire Hornsea Four commercial fisheries study area by weight from 2012 to 2016. The key species are brown crab *Cancer pagarus* and King scallop *Pecten maximus*, targeted primarily by UK potters and dredgers. Brown crab represent the most significant landings by weight across the inshore and southern portion of the study area in ICES rectangles 37E9, 36E9, 36F0 and 36F1. Landings have steadily increased over the five-year study period, peaking at over 5,500 tonnes in 2016. Scallop landings originate primarily from inshore ICES rectangle 37E9, and annual landings fluctuate markedly over the five-year study period, peaking in 2015 at over 2,800 tonnes. Other species of importance based on landings weight include whiting *Merlangius merlangus*, lobsters *Homarus gammarus*, whelks *Buccinum undatum*, plaice *Pleuronectes platessa* and mackerel *Scomber scombrus*.

6.8.3.7 Figure 6-37 shows, for landings by UK vessels only, the top twelve species landed from the entire Hornsea Four commercial fisheries study area by value, from 2012 to 2016 (MMO, 2017). The key species in terms of value (excluding herring and sandeel and other species landed by foreign vessels) are lobster, brown crab and King scallop. When compared with the weight of landings in the Hornsea Four commercial fisheries study area, it can be seen that while catches of lobsters are considerably lower by weight than brown crabs, their value exceeds that of brown crab, owing to a higher market price. The data suggests that both brown crab and lobster landings are of particular importance in the Hornsea Four commercial fisheries study area and are the most valuable landings in all five years of the study period. Scallop landings values fluctuate across the five-year period, peaking markedly in 2015 and reflecting a peak in landings weight. It is also worth noting that a number of species with low catch weights have relatively high total values (e.g. cod *Gadus morhua* and Norway lobster *Nephrops norvegicus*) and can also be considered key target species in the commercial fisheries study area.

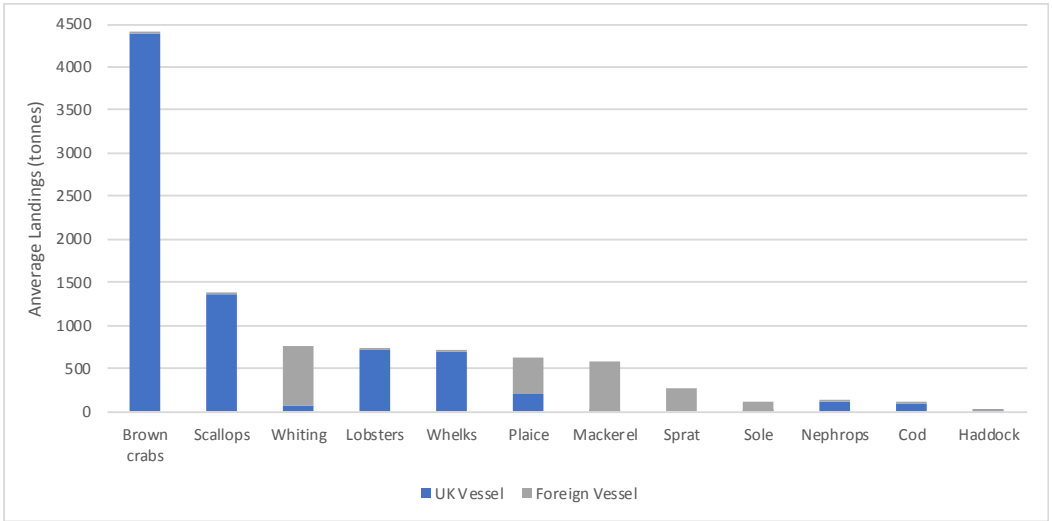


Figure 6-36 - Top twelve species by weight (tonnes) from 2012 to 2016 landed from the Hornsea Four commercial fisheries study area by vessel nationality, excluding sandeel and herring (EU DCF, 2018).

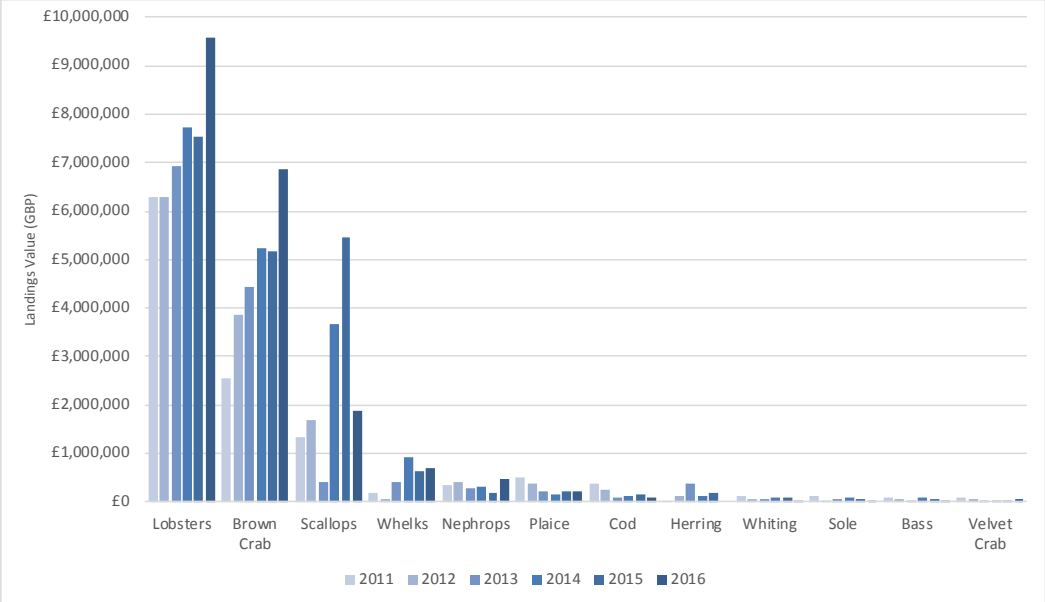
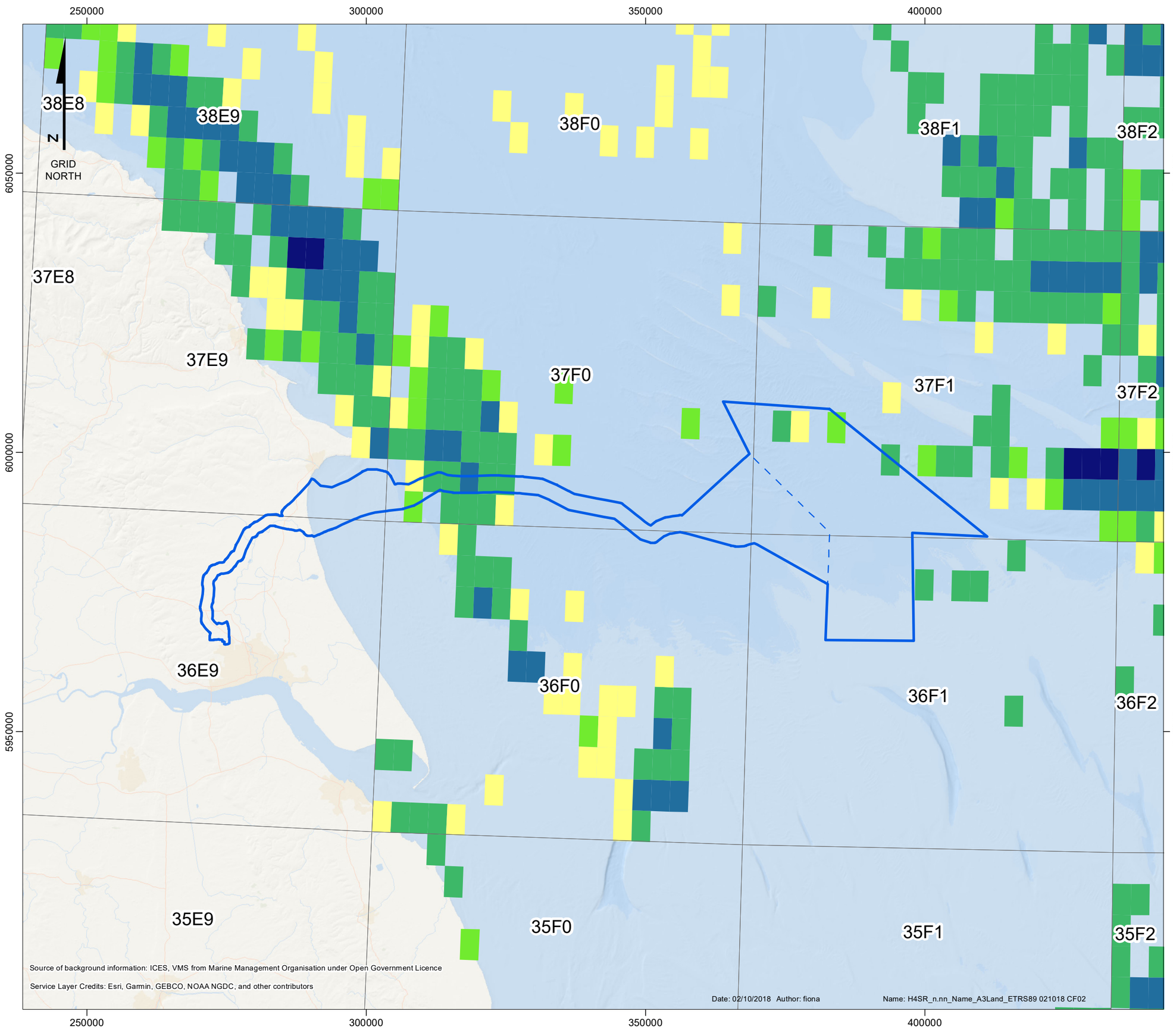


Figure 6-37 - Top twelve species by value (GBP) from 2012 to 2016 landed from the Hornsea Four commercial fisheries study area by UK vessels only (MMO, 2017).

6.8.3.8 In addition to landings data, VMS data have also been obtained for all ICES Rectangles within the commercial fisheries study area from 2012 to 2016 (MMO, 2018). From **Figure 6-38** and **Figure 6-39**, it can be seen that UK dredgers are by far the most active type of mobile fishing vessel across Hornsea Four. Significant dredge activity is seen running parallel to the coast and overlapping with the offshore ECC. Other mobile trawling activity is limited within the commercial fisheries study area, with occasional fishing by demersal and beam trawlers. **Figure 6-38** and **Figure 6-39** show sparse fishing activity within the Hornsea Four array area (northern extents).

6.8.3.9 **Figure 6-40** and **Figure 6-41** indicate that significant potting activity occurs for ≥ 15 m vessels which continue to be active in waters further offshore, extending across the southern portion of the commercial fisheries study area and into the Hornsea Four array area. These VMS figures do not include activity for vessels <15 m in length and therefore largely under-represent the activity of the potting fleet which consists of predominately <15m vessels. However, the VMS data is likely to be more reflective of activity further offshore and across the array area based on typical operating ranges of vessels captured in this dataset.

Hornsea Four
VMS mobile value
Figure 6.38



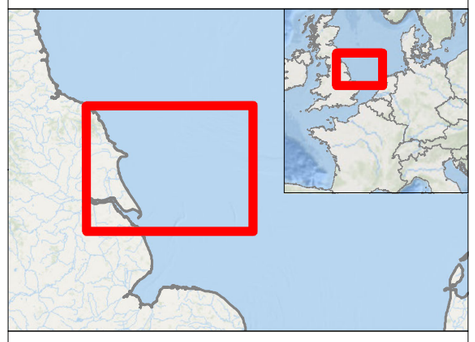
Scoping Boundary

Array Area

ICES Statistical Rectangles

Mobile 2016 Value (£)

- 1 - 500
- 501 - 1,000
- 1,001 - 10,000
- 10,00 - 50,000
- 50,001 - 120,000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:653250

0 4 8 16 24 32 Kilometres

0 2 4 8 12 Nautical Miles

VMS mobile value
Document no: H4SR_CF02
Created by: FN
Checked by: SM
Approved by: LK

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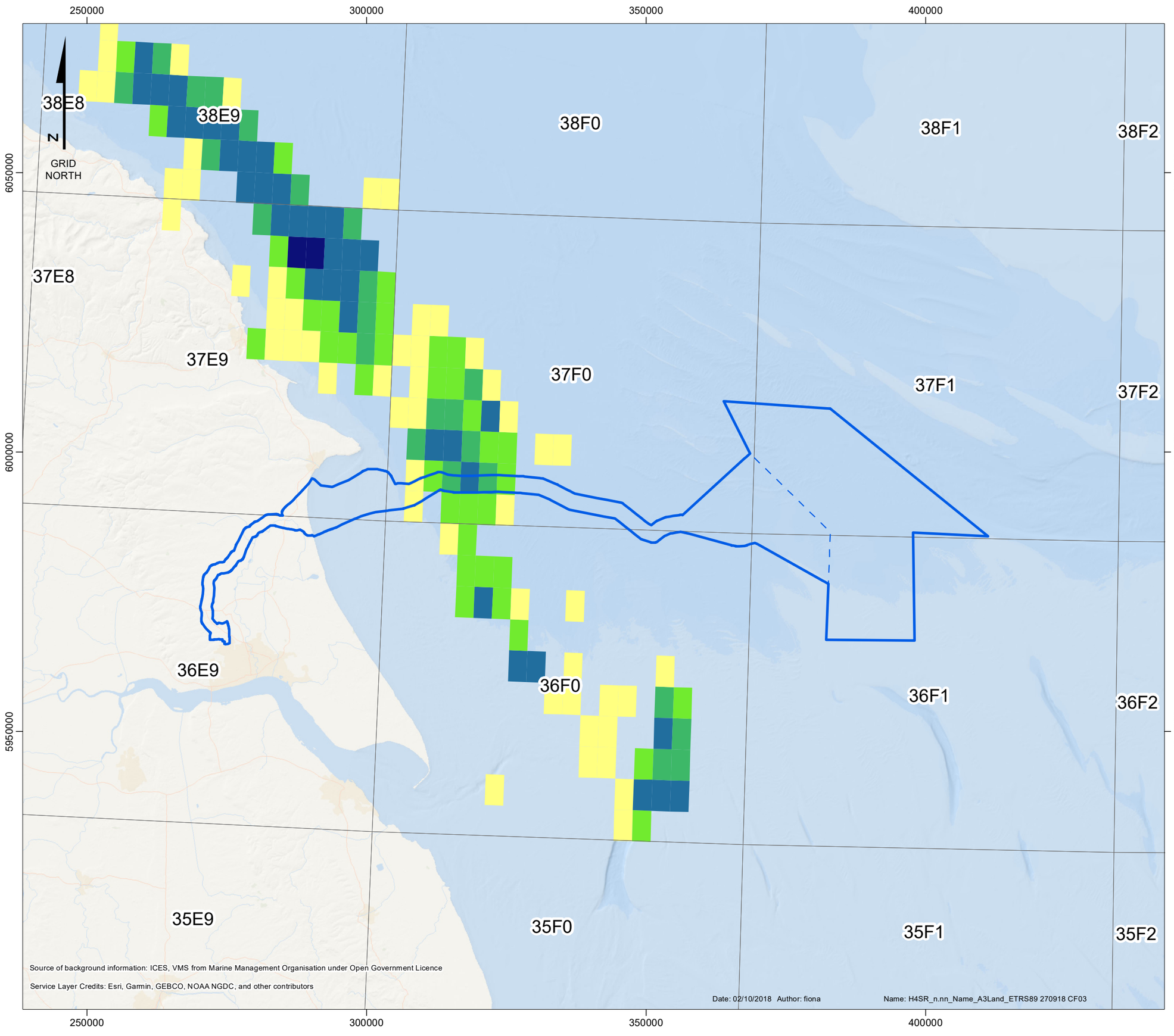
Hornsea Four
VMS dredge value
Figure 6.39



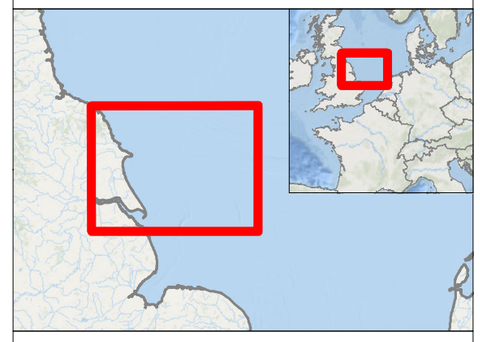
Scoping Boundary

Array Area

ICES Statistical Rectangles

Dredge 2016 Value (£)

- 1 - 1,000
- 1,001 - 5,000
- 5,001 - 10,000
- 10,001 - 50,000
- 50,001 - 120,000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:653250

0 4 8 16 24 32 Kilometres

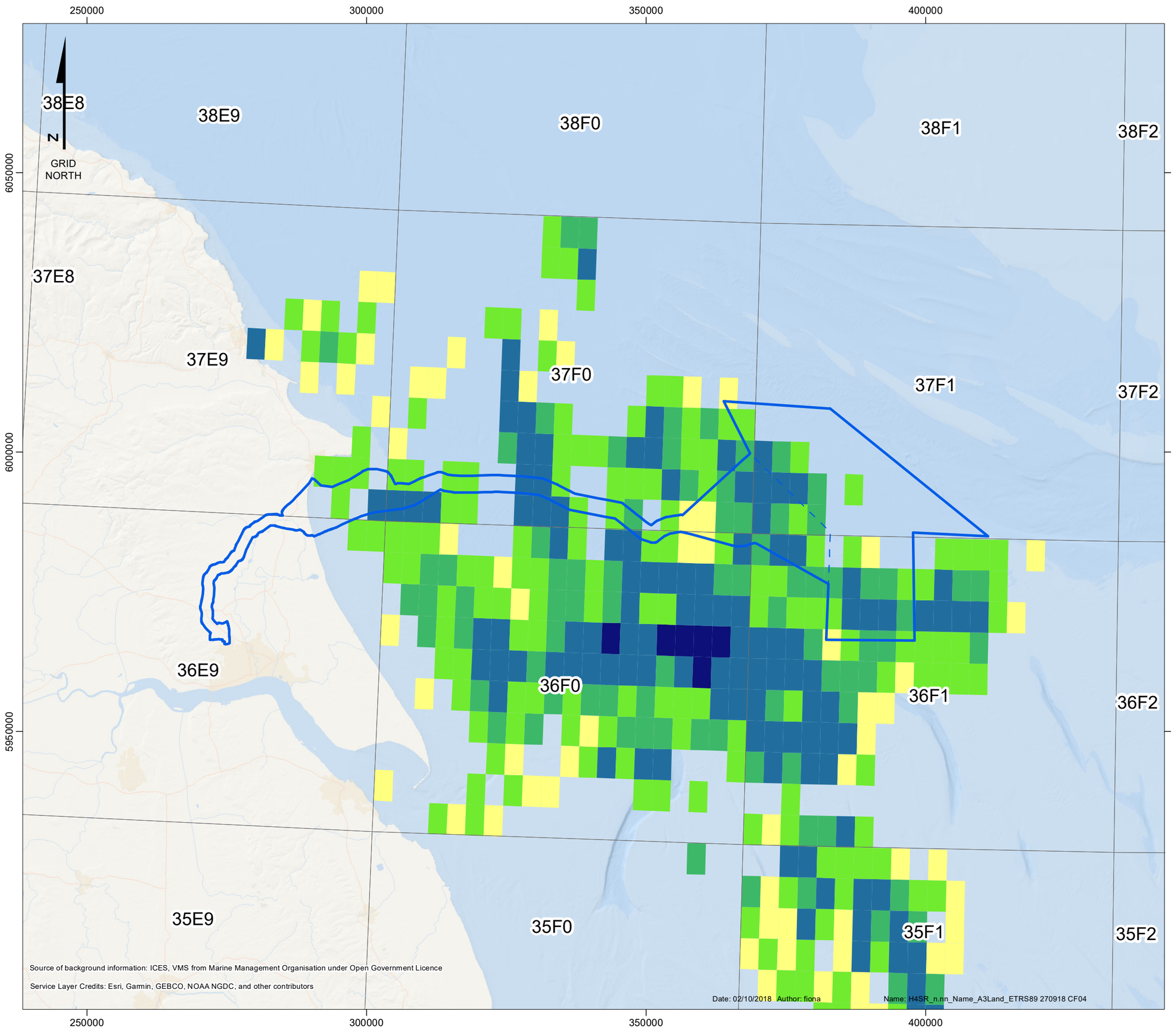
0 2 4 8 12 Nautical Miles

VMS dredge value
Document no: H4SR_CF03
Created by: FN
Checked by: SM
Approved by: LK

POSEIDON AQUATIC RESOURCE MANAGEMENT

Ørsted

Hornsea Four
VMS passive value
Figure 6.40



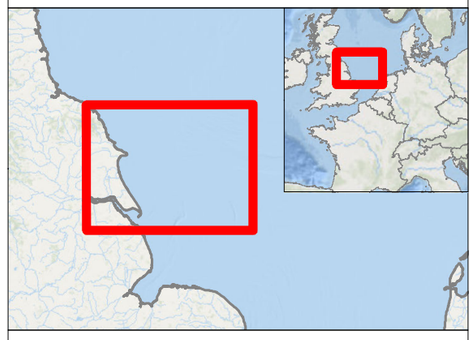
Scoping Boundary

Array Area

ICES Statistical Rectangles

Passive 2016 Value (£)

- 5 - 1000
- 1001 - 5000
- 5001 - 10000
- 10001 - 50000
- 50001 - 120000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:653250

0 4 8 16 24 32 Kilometres

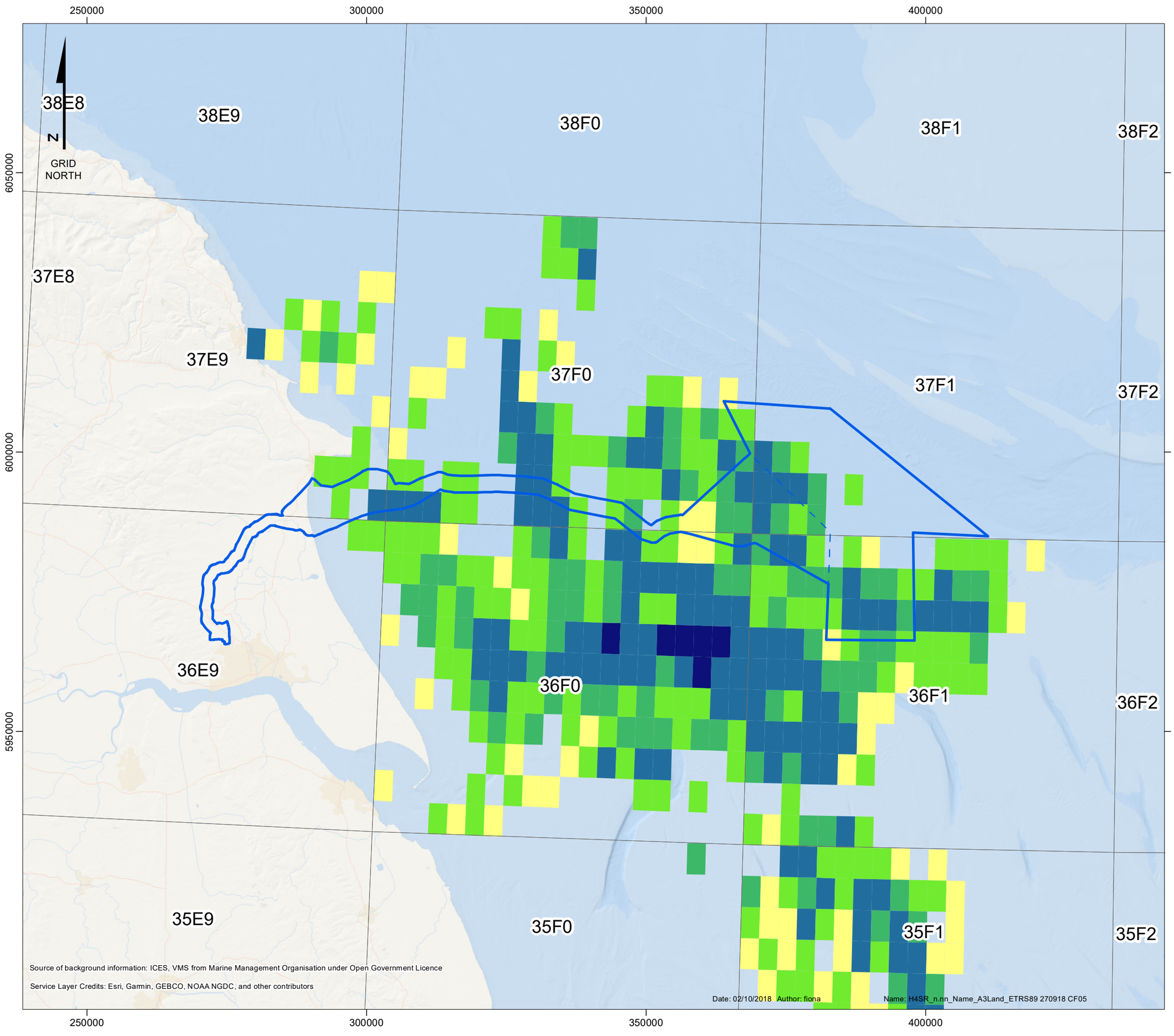
0 2 4 8 12 Nautical Miles

VMS passive value
Document no: H4SR_CF04
Created by: FN
Checked by: SM
Approved by: LK

POSEIDON AQUATIC RESOURCE MANAGEMENT

Ørsted

Hornsea Four
VMS pots value
Figure 6.41



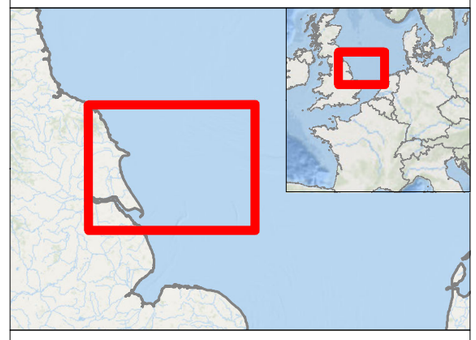
Scoping Boundary

Array Area

ICES Statistical Rectangles

Pots 2016 Value (£)

- 5 - 1000
- 1001 - 5000
- 5001 - 10000
- 10001 - 50000
- 50001 - 120000



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:653250

0 4 8 16 24 32 Kilometres

0 2 4 8 12 Nautical Miles

VMS pots value
Document no: H4SR_CF05
Created by: FN
Checked by: SM
Approved by: LK

POSEIDON AQUATIC RESOURCE MANAGEMENT

Ørsted

Summary and Key Issues

6.8.3.10 The key fleets operating across the Hornsea Four array area and offshore ECC include (in no particular order):

- UK potters targeting brown crab, lobster and whelk (vessels typically 15 m and under in length, but also including >15m vessels), operating across the offshore ECC and southern portion of the Hornsea Four array area;
- UK scallop dredgers, operating across the offshore ECC;
- Danish otter trawlers targeting sandeel (vessels >25 m in length), including specific fishing grounds within the Hornsea Four array area;
- Dutch, German, French and Danish pelagic trawlers (vessels 15 to 25m in length) targeting highly mobile species that consistently move/shoal throughout the wider southern North Sea, including herring, whiting and mackerel, operating within the Hornsea Four array area;
- UK demersal otter trawlers targeting Nephrops and mixed demersal species (vessels typically >15 m in length), operating within the Hornsea Four array area; and
- UK (Dutch owned), Dutch and Belgian beam trawlers targeting mixed demersal species (vessels >15 m in length), operating across the Hornsea Four array area.

6.8.3.11 The Hornsea Four array area and offshore ECC avoid the areas of greatest fishing effort, with for example, potting activity being more significant to the south of the array area and offshore ECC, and dredging being concentrated to the north of the offshore ECC. However, a range of potential impacts on commercial fisheries may occur during the construction, operation and maintenance, and decommissioning phases of Hornsea Four, as presented in **section 6.8.6** below. The fleets listed above are considered to be sensitive to a potential reduction in access to the Hornsea Four array area and offshore ECC, and any resulting displacement, leading to gear conflict and increased fishing pressure elsewhere. Based on their characteristics, some fleets are considered more sensitive than others to these impacts, as described in **Table 6-33** below. For example, the inshore potting fleet operates over distinct areas and has a lesser range than other fleets, and without access to alternative fishing grounds, is likely to be more sensitive to exclusion and displacement effects than the larger mobile-gear fleets.

6.8.4 Project Basis for Scoping Assessment

6.8.4.1 The commercial fisheries scoping assessment is based on the following construction phase maximum design scenario:

- seabed preparation and installation of up to 180 WTGs on gravity base structure foundations with scour protection;
- seabed preparation and installation of up to ten offshore substations and accommodation platforms within the array area on gravity base structure foundations with scour protection;
- seabed preparation and installation of up to three offshore HVAC booster substations along the ECC on gravity base structure foundations with scour protection;
- seabed preparation and installation of offshore export cables, inter-array cables and interconnector cables and associated cable protection; and
- construction activity taking place in a single phase across a period of approximately 2.5 years.

6.8.4.2 The commercial fisheries scoping assessment is based on the following operational phase maximum design scenario:

- presence of 180 WTGs on gravity base structure foundations with scour protection;
- presence of up to ten offshore substations and accommodation platforms within the array areas on gravity base structure foundations with scour protection;
- presence of up to three offshore HVAC booster substations along the ECC on gravity base structure foundations with scour protection; and
- presence of some limited extent of cable protection along offshore export cables, inter-array cables and interconnector cables.

6.8.4.3 The commercial fisheries scoping assessment is based on the following decommissioning phase maximum design scenario:

- decommissioning of up to 180 WTGs on gravity base structure foundations with scour protection left in-situ;
- decommissioning of up to ten offshore substations and accommodation platforms within the array area on gravity base structure foundations with scour protection left in-situ; and
- decommissioning of up to three offshore booster substations along the ECC on gravity base structure foundations with scour protection left in-situ.

6.8.4.4 The basis for assessment also includes embedded mitigation (detailed in **section 6.8.5** below) where appropriate.

6.8.5 Embedded Mitigation

6.8.5.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed to reduce the potential for impacts on commercial fisheries. These are presented in **Table 6-32**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

6.8.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section 6.8.6** (i.e. the determination of likely magnitude and therefore significance assumes implementation of these measures).

Table 6-32 - Relevant Commercial Fisheries Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co81	Primary: A scour protection layer (typically rock) may be needed where cable burial depths cannot be obtained.	Secured in the dMLs through the requirement for a SPMP and CSIP.
Co83	Primary: Undertake a cable burial risk assessment to inform front end engineering works. Cable burial will be the preferred option for cable protection.	Secured in the dMLs through the requirement for a CSIP.

Commitment ID	Measure Proposed	How the Measure will be Secured
Co89	Tertiary: Advance warning and accurate location details of construction/maintenance/decommissioning operations and associated Safety Zones and advisory safety distances will be given to fishing fleets (including via Notices to Mariners and Kingfisher Bulletins).	Secured in the dMLs through the requirements for notifications.
Co90	Tertiary: Ongoing liaison with fishing fleets will be maintained during construction/maintenance/decommissioning operations via an appointed Fisheries Liaison Officer and Fishing Industry Representative.	Secured in the dMLs through the requirement for a PEMMP and Fisheries Co-Existence and Liaison Plan (FCLP).
Co91	Tertiary: Guard vessels will be used, where appropriate, during construction/maintenance/decommissioning operations to ensure communication of and adherence to Safety Zones and advisory safety distances.	Secured in the dMLs through the requirement for a CMS and through the application for Safety Zones.
Co92	Tertiary: All infrastructure (including partially constructed/decommissioned) will be designed, marked and lit in accordance with standard industry guidance including MGN 543 and as advised by IALA and Trinity House.	Secured in the dMLs through the requirement for an Aid to Navigation Management Plan (ANMP).
Co93	Tertiary: Aids to navigation will be deployed in accordance with standard industry guidance.	Secured in the dMLs through the requirement for an ANMP.
Co94	Tertiary: Notifications will be made to the relevant bodies (e.g. United Kingdom Hydrographic Office) to allow marking of all installed infrastructure on charts.	Secured in the dMLs through the requirements for notifications.
Co95	Tertiary: A fisheries co-existence and liaison plan will be prepared in advance of construction commencing.	Secured in the dMLs through the requirement for a FCLP.
Co111	Tertiary: A PEMMP (construction and operation phases) and Decommissioning Plan (decommissioning phase) will be produced and followed. The PEMMP and Decommissioning Plan will cover the construction, operation and maintenance, and decommissioning phases of Hornsea Four respectively and will include a MPCP. This MPCP will outline procedures to protect personnel working and to safeguard the marine environment in the event of an accidental pollution event arising from offshore operations relating to Hornsea Four. The MPCP will also outline mitigation measures should an accidental spill occur, address potential contaminant releases and include key emergency contact details (e.g. Environment Agency, Natural England and the MCA).	Secured in the dMLs through the requirement for a PEMMP and Decommissioning Programme.

6.8.6 Likely Significant Effects

6.8.6.1 Table 6-33 sets out an assessment of effects on commercial fisheries at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.8.6.2 The assessment presented in Table 6-33 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out

in Table 6-32, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for commercial fisheries effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified commercial fisheries practitioners.

6.8.6.3 Table 6-33 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.8.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 6-33 - Likely Effects – Commercial Fisheries

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction phase: Hornsea Four array area construction activities and physical presence of constructed wind farm infrastructure leading to reduction in access to, or exclusion from established fishing grounds.	Tertiary Co89 Co90 Co91 Co92 Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Liely significant effect without secondary mitigation** Effect likely to be of negligible to minor adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over construction period, though effect is short-term and localised, and the operational range of fleets is typically not limited to the array area.	Scoped In A detailed assessment based on baseline data analysis and consultation in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array area, and access to alternative grounds, and assess the effects of exclusion/reduced access.	Most up-to-date versions of publicly available data sources (e.g. UK landings data for 2017 will be available). Consultation with fleets active in the area to corroborate findings of data analysis and understand the specifics of fleet operation and grounds targeted.
Construction phase: Hornsea Four offshore cable corridor construction activities leading to reduction in access to, or exclusion from established fishing grounds.	Tertiary Co89 Co90 Co91 Co92 Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of not significant to moderate adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over construction period, though effect is short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.	Scoped In A detailed assessment approach will be adopted, as described above, and as relevant to the offshore ECC.	As above.
Construction phase: Displacement from Hornsea Four array area leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89 Co90 Co91 Co92 Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of negligible to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the array area.	Scoped In A detailed assessment approach will be adopted involving detailed analysis of multiple existing datasets and consultation with national (and international where relevant) fleets in order to characterise commercial fisheries activity in the study area and consider the	As above.

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
					potential nature and extent of displacement and implications for/of gear conflict.	
Construction phase: Displacement from the Hornsea Four offshore cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89 Co90 Co91 Co92 Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of negligible to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.	Scoped In A detailed assessment approach will be adopted, as described above and as relevant to the offshore ECC.	As above.
Construction phase: Hornsea Four array area and offshore cable corridor construction activities leading to displacement or disruption of commercially important fish and shellfish resources.	None	Minor	Medium	**No likely significant effect**	**Scoped out**	N/A
Construction phase: Hornsea Four array area and Hornsea Four offshore cable corridor construction activities leading to additional steaming to alternative fishing grounds for vessels that would otherwise be fishing within the array and export cable areas.	Tertiary Co89 Co90 Co91 Co92 Co95	Fleet dependent; up to Minor	Fleet dependent; up to Low	**No likely significant effect**	**Scoped out**	N/A
Construction phase: Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting construction vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor leading to interference with fishing activity.	Tertiary Co89 Co90 Co91 Co92 Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**No likely significant effect**	**Scoped out**	N/A

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operation and Maintenance phase: Physical presence of Hornsea Four array area infrastructure leading to reduction in access to, or exclusion from established fishing grounds.	Primary Co81 Co83 Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Assumes fishing can resume to a degree within the array area. Effect will be long-term but highly localised and operational range of most fishing vessels is not limited to the array area.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	Most up-to-date versions of publicly available data sources (e.g. UK landings data for 2017 will be available for consideration). Consultation with fleets active in the area to corroborate findings of data analysis and understand the specifics of fleet operation and grounds targeted.
Operation and Maintenance phase: Physical presence of offshore export cable and infrastructure within the Hornsea Four offshore cable corridor leading to reduction in access to, or exclusion from established fishing grounds.	Primary Co81 Co83 Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Assumes fishing can resume to a degree within the array area. Effect will be long-term but highly localised and operational range of most fishing vessels is not limited to the offshore ECC.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Operation and Maintenance phase: Displacement from Hornsea Four array area and Hornsea Four offshore cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds.	Primary Co81 Co83 Tertiary Co89 Co94 Co90 Co91 Co92 Co93	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Assumes fishing can resume to a degree in array area and in vicinity of export cables. Effect will be highly localised and operational range of most fishing vessels is not limited to the array area or offshore ECC.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
	Co95					
Operation and Maintenance phase: Physical presence of Hornsea Four array area leading to gear snagging.	Primary Co81 Co83 Tertiary Co89 Co94 Co90 Co92 Co93 Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Standard industry practice and protocol (i.e., seabed infrastructure will be buried and/or marked on charts) minimise this risk, but it remains likely to be an area of industry concern.	Scoped In A detailed assessment approach will be adopted involving detailed analysis of multiple existing datasets and consultation with national (and international where relevant) fleets in order to characterise commercial fisheries activity in the study area and consider the potential nature and extent of risk of gear snagging and associated implications.	As above.
Operation and Maintenance phase: Physical presence of the export cable and associated infrastructure leading to gear snagging.	Primary Co81 Co83 Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Standard industry practice and protocol (i.e., seabed infrastructure will be buried and/or marked on charts) minimise this risk, but it remains likely to be an area of industry concern.	Scoped In A detailed assessment approach will be adopted, as described above and as relevant to the offshore ECC.	As above.
Operation and Maintenance phase: Hornsea Four operation and maintenance activities leading to displacement or disruption of commercially important fish and shellfish resources.	Primary Co81 Co83 Tertiary Co94	Minor	Medium	**No likely significant effect**	**Scoped out**	N/A
Operation and Maintenance phase: Physical presence of the Hornsea Four array area and export cable leading to additional steaming to alternative fishing grounds for	Tertiary Co89 Co94 Co90 Co91 Co92 Co93	Fleet dependent; Negligible	Fleet dependent; Low	**No likely significant effect**	**Scoped out**	N/A

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
vessels that would otherwise be fishing within the Hornsea Four array area and offshore cable corridor.	Co95					
Operation and Maintenance phase: Increased vessel traffic within fishing grounds as a result of changes to shipping routes and maintenance vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor infrastructure leading to interference with fishing activity.	Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95	Fleet dependent; Negligible	Fleet dependent; Low	**No likely significant effect**	**Scoped out**	N/A
Decommissioning phase: Hornsea Four array area decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds.	Tertiary Co89 Co94 Co90 Co91 Co92, Co93 Co95 Co111	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** As described for the construction phase; effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over decommissioning period, though effect is short-term and localised, and the operational range of fleets is typically not limited to the array area.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	Most up-to-date versions of publicly available data sources (e.g. UK landings data for 2017 will be available for consideration). Consultation with fleets active in the area to corroborate findings of data analysis and understand the specifics of fleet operation and grounds targeted.
Decommissioning phase: Hornsea Four offshore export cable decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds.	Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** As described for the construction phase; effect likely to be of not significant to moderate adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over decommissioning period,	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
	Co111			though effect is short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.		
Decommissioning phase: Displacement from Hornsea Four array area leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95 Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** As described for the construction phase; effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the array area.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Decommissioning phase: Displacement from the Hornsea Four offshore cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95 Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** As described for the construction phase; effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Decommissioning phase: Physical presence of any infrastructure left in situ leading to gear snagging.	Primary Co81 Co83 Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95 Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** As described for the operation and maintenance phase; effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Standard industry practice and protocol (i.e., seabed infrastructure will be buried and/or marked on charts) minimise this risk, but it remains likely to be an area of industry concern.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during operation.	As above.
Decommissioning phase: Decommissioning activities leading to displacement or	None	Minor	Medium	**No likely significant effect**	**Scoped out**	N/A

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
disruption of commercially important fish and shellfish resources.						
Decommissioning phase: Decommissioning activities leading to longer steaming distances to alternative fishing grounds.	Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95 Co111	Minor	Low	**No likely significant effect**	**Scoped out**	N/A
Decommissioning phase: Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting decommissioning vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor leading to interference with fishing activity.	Tertiary Co89 Co94 Co90 Co91 Co92 Co93 Co95 Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**No likely significant effect**	**Scoped out**	N/A

6.8.7 Impacts Scoped Out of Assessment

6.8.7.1 The determination of the impacts that are scoped into or out of assessment has been based on a combination of factors, including the results of the commercial fisheries assessment for previous Hornsea Projects and the expert judgement of Poseidon Aquatic Resource Management based on their involvement in previous impact assessments for offshore wind farms of a similar scale in UK waters.

6.8.7.2 The significance of impacts resulting from Hornsea Four are likely to be analogous to those assessed at the previous Hornsea Projects, which in some cases support the same fishing fleets as those understood to be active in the Hornsea Four development area. Thus, it was possible to identify impact pathways that would likely have no significant impact on commercial fisheries and which could be scoped out of assessment for Hornsea Four.

6.8.7.3 The following text details the impact pathways that were scoped out of further detailed assessment.

Displacement or disruption of commercially important fish and shellfish resources (during construction, operation and decommissioning)

6.8.7.4 Effects of Hornsea Four on species of commercial importance are not expected to be significant in EIA terms and scoped out of further fish and shellfish ecology assessment (see **section 6.4**). Reflecting this conclusion, and in line with the findings of the impact assessments for the previous Hornsea Projects, any resulting effect on commercial fisheries is not expected to be significant in EIA terms and is scoped out of further assessment.

Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Hornsea Four development area (during construction, operation, decommissioning)

6.8.7.5 This effect will be localised and limited deviations to steaming routes are expected. Given adequate notification, it is expected that vessels, which typically have an operational range beyond that the Hornsea Four development area, will be in a position to avoid temporary construction/decommissioning areas and installed infrastructure with no or minimal impact on their steaming times.

6.8.7.6 In line with the conclusions of the impact assessments for the previous Hornsea Projects, this effect is not expected to be significant in EIA terms and is scoped out of further assessment.

Increased vessel traffic within fishing grounds leading to interference with fishing activity (during construction, operation, decommissioning)

6.8.7.7 Vessel movements associated with Hornsea Four construction, operation and maintenance, and decommissioning, will add to the existing volume of traffic in the area.

However, the effect will be localised and given adequate notification, fleets will be able to avoid Hornsea Four vessel traffic.

6.8.7.8 In line with the conclusions of the impact assessments for the previous Hornsea Projects, this effect is not expected to be significant in EIA terms and is scoped out of further assessment.

6.8.8 Proposed Approach to the PEIR and ES

6.8.8.1 Detailed analysis of existing baseline datasets (see **section 6.8.3.1**) will be undertaken to characterise long-term patterns in commercial fisheries activity across the commercial fisheries study area and predict the potential impacts upon future commercial fishing activities. Additional datasets to those listed in **section 6.8.3.1** will be sought.

6.8.8.2 For areas close to shore within the offshore ECC, where vessels less than 15 m in length operate (which are not captured by VMS data), aerial surveillance data (available from the MMO) and monthly shellfish activity returns (available from the local IFCA) will provide an insight into fisheries activity, and consultation with the commercial fishing industry will be undertaken to ground-truth available baseline data and gain further understanding of the fishing activity by smaller vessels across the commercial fisheries study area.

6.8.8.3 This information may be supplemented by the results of vessel-based fishing activity reconnaissance survey work that have been undertaken by Ørsted in the area.

6.8.8.4 Recent data from Danish, Dutch, German and French authorities for their fleets fishing within the Hornsea Four commercial fisheries study area will also be collected during consultation. It is anticipated that data would include VMS and landing statistics by ICES rectangle. Additional datasets including maps of key fishing grounds may also be available.

6.8.8.5 A detailed analysis of the above data sources will inform an extended baseline characterisation of the commercial fisheries study area. This, together with industry consultation, will underpin the impact assessment for each of the scoped in impacts detailed in **Table 6-33**.

6.8.8.6 The commercial fisheries EIA will follow the methodology set out in **Annex C**. Specific to the commercial fisheries EIA, the following guidance documents will also be considered:

- Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (UKFEN, 2013);
- Fisheries Liaison with Offshore Wind and Wet Renewables group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers (BERR, 2008 and FLOWW, 2014);
- FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015);

- options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010a); and
- developing guidance on fisheries Cumulative Impact Assessment for wind farm developers (Blyth-Skyrme, 2010b).

6.8.9 Scoping Questions for Consultees

6.8.9.1 The following questions are posed to consultees to help them frame and focus their response to the commercial fisheries scoping exercise, which will in turn inform the Scoping Opinion:

1. Do you agree that the data sources identified are sufficient to inform the commercial fisheries baseline for the Hornsea Four PEIR and ES?
2. Have all potential impacts on commercial fisheries resulting from Hornsea Four been identified within this Scoping Report?
3. Do you agree with the proposed approach to assessment (scoped in or out, and detailed or simple assessment) for each of the impacts in the Likely Significant Effects table?
4. Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of Hornsea Four on commercial fisheries receptors?
5. For those impacts scoped in, do you agree that the methods described are sufficient to inform a robust impact assessment?

6.9 Shipping and Navigation

6.9.1 Introduction

6.9.1.1 This section of the Scoping Report identifies the shipping and navigation receptors of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components (i.e. seaward of MHWS) of Hornsea Four on shipping and navigation.

6.9.2 Study Area

6.9.2.1 The study area for this assessment extends 10 nautical miles (NM) from the Hornsea Four array area, and two NM from the offshore ECC (see **Figure 6-42**). This study area was discussed and agreed with the Maritime and Coastguard Agency (MCA) and Trinity House Light Service (THLS) during pre-scoping consultation (2nd August 2018).

6.9.2.2 In addition, and where relevant, shipping routes across the North Sea have been considered in terms of how they interact with the former Hornsea Zone.

6.9.3 Baseline Environment

Data Sources used for Scoping

6.9.3.1 The datasets outlined in **Table 6-34** have been used in the baseline study.

Table 6-34 - Key Sources of Shipping and Navigation Data

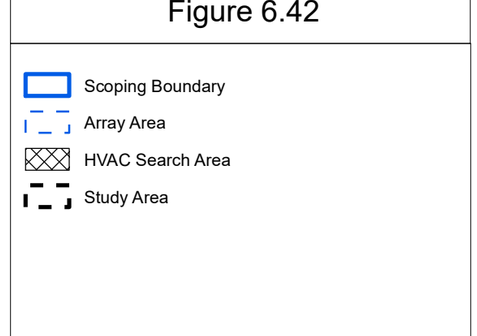
Source	Summary	Coverage of Hornsea Four array area and ECC
Automatic Identification System (AIS) data	Data from the Automatic Identification System (AIS) for the 1st April 2017 to the 31st March 2018 collected by Ultramap. AIS data includes all large commercial vessels, passenger vessels, larger fishing vessels and some recreational vessels. This dataset therefore provides a thorough baseline dataset of shipping activity in the study area.	The dataset covers a 10 km radius around the array area and a 20 km cross section of vessel traffic to the west, including a large proportion of the ECC.
Incident data provided by the Marine Accident Investigation Branch (MAIB)	Data for the years 1997 to 2015. This data includes the locations and details of all marine incidents within the study area and provides an understanding of the baseline risk profile in the area.	Full coverage of the array area and ECC
Vessel Monitoring System (VMS) data	Data from the Marine Management Organisation (MMO) to understand key areas of fishing activity.	Full coverage of the array area and ECC

Source	Summary	Coverage of Hornsea Four array area and ECC
Royal Yachting Association (RYA) data	Recreational cruising routes developed by the RYA to provide a greater understanding of recreational activity.	Full coverage of the array area and ECC

6.9.3.2 Consultation was undertaken with the MCA and Trinity House in order to identify possible impacts to shipping & navigation and have informed the topics considered in this scoping assessment. An approach and scope to vessel traffic surveys was also agreed with both bodies and these surveys will be conducted to support the Navigational Risk Assessment (NRA) and the EIA (see **section 6.9.7**).

Hornsea Four
Study Area
Figure 6.42

Scoping Boundary
Array Area
HVAC Search Area
Study Area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Study Area
Document no: H4SR_SN01
Created by: AR
Checked by: RW
Approved by: JJH

MARICO MARINE

Ørsted

Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Date: 02-Oct-18 Author: AR Name: H4SR_SN01_StudyArea_A3Land_ETRS89

Overview of Baseline Environment

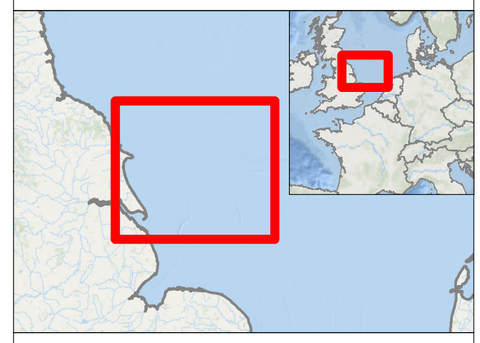
6.9.3.3 Hornsea Four array area is positioned in the North Sea, approximately 65 km from shore and is near to a number of major shipping routes and other users of the sea. **Figure 6-43** and **Figure 6-44** show the tracks of commercial cargo and tanker vessels obtained from the AIS data collected during 2017/2018. A number of significant shipping routes pass through the Hornsea Four array area. These are principally northeast/southwest orientations of vessels transiting between the Humber Estuary and the entrance to the Baltic Sea. Other routes passing through the site orientate between northeast England and Scottish / European ports in the southern North Sea. A greater amount of traffic passes across the offshore ECC. Commercial shipping is also recorded at anchor near to the offshore ECC landfall.

6.9.3.4 Passenger vessel routes are shown in **Figure 6-45**. The key route identified is the Newcastle to Amsterdam DFDS ferry. This ferry service operates daily, seven days a week. In addition to this key route, some cruise ship activity was recorded in the data passing through, or near to, the Hornsea Four array area.

Hornsea Four
Cargo Vessel Tracks
Figure 6.43

Scoping Boundary

Cargo Vessel Tracks



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Study Area
Document no: H4SR_SN02
Created by: AR
Checked by: RW
Approved by: JJH

MARICO MARINE

Ørsted

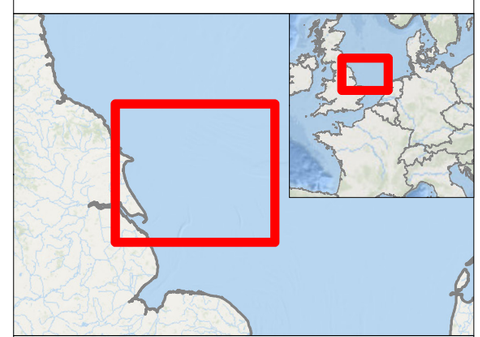
Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
AIS Data Provided by Ultramap

Date: 02/10/2018 Author: AR Name: H4SR_SN02_CargoTracks_A3Land_ETRS89

Hornsea Four
Tanker Vessel Tracks
Figure 6.44

Scoping Boundary

Tanker Vessel Tracks



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Tanker Vessel Tracks
Document no: H4SR_SN03
Created by: AR
Checked by: RW
Approved by: JJH

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Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
AIS Data Provided by Ultramap

Date: 02/10/2018 Author: AR Name: H4SR_SN03_TankerTracks_A3Land_ETRS89

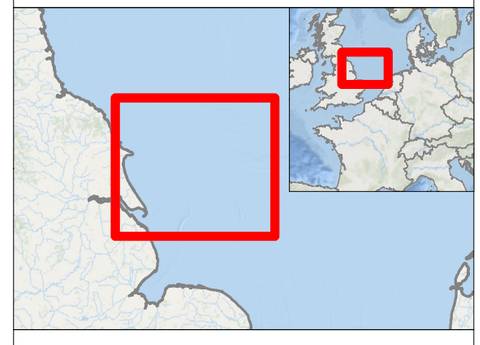
300000 350000 400000

6050000 6000000 5950000

Hornsea Four
Passenger Vessel Tracks
Figure 6.45

Scoping Boundary

Passenger Vessel Tracks



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Passenger Vessel Tracks
Document no: H4SR_SN04
Created by: AR
Checked by: RW
Approved by: JJH

MARICO MARINE

Ørsted

Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
AIS Data Provided by Ultramap

Date: 02/10/2018 Author: AR Name: H4SR_SN04_PassengerTracks_A3Land_ETRS89

6.9.3.5 Figure 6-46 illustrates the tracks of recreational craft that were recorded in the AIS data. AIS is not mandated aboard recreational vessels and therefore this plot provides only a sample of traffic. The radar vessel traffic survey that is planned to be undertaken to support the Navigation Risk Assessment (NRA) will provide a clearer picture of recreational routes. Of those recorded, the vast majority are well inshore of the Hornsea Four array area and near to where the offshore ECC makes landfall. Given the distance of Hornsea Four offshore, it is unlikely that any significant recreational activity takes place in the study area.

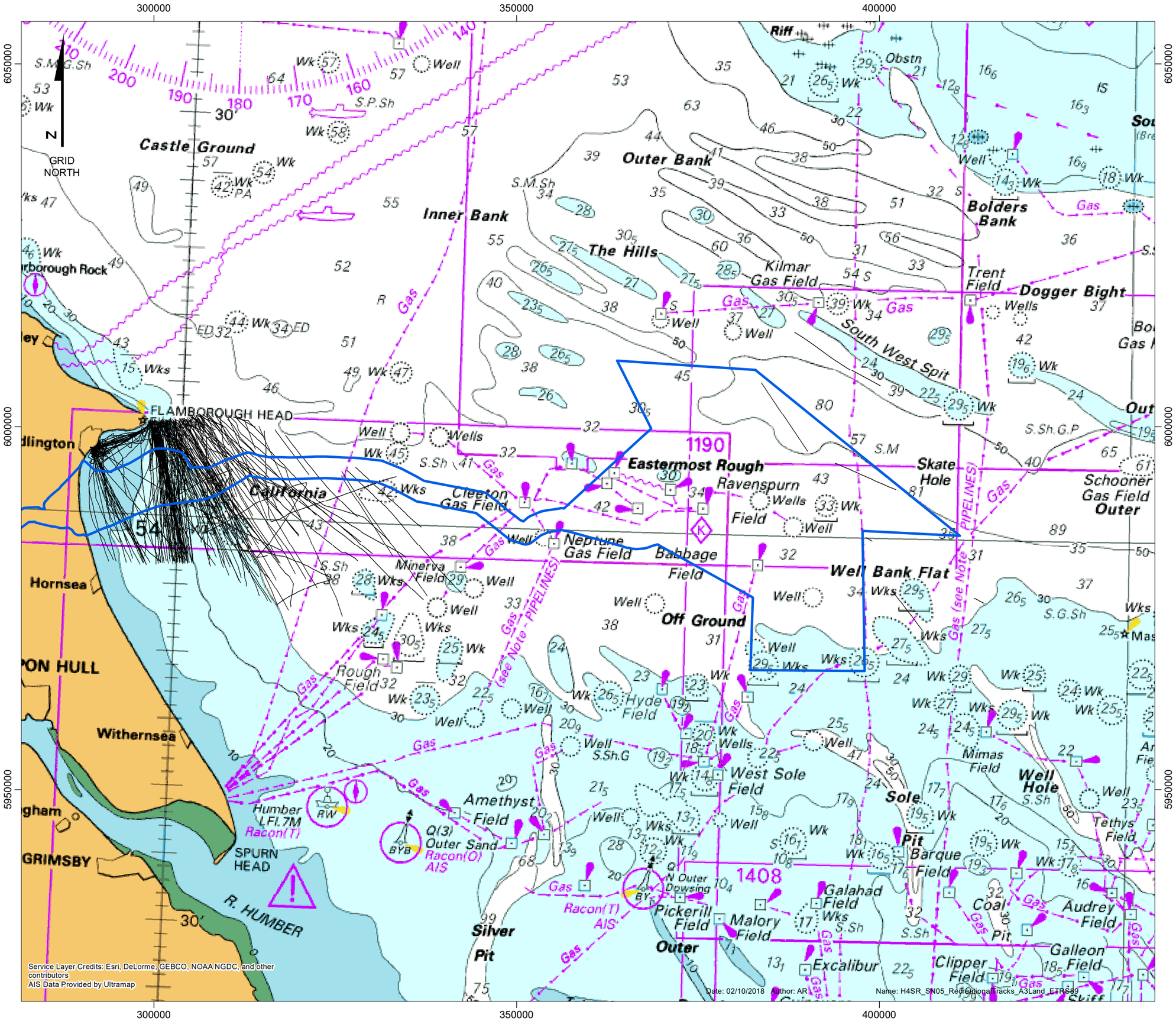
6.9.3.6 Figure 6-47 shows the tracks of those fishing vessels which carry AIS. Some fishing activity is recorded near to the Hornsea Four array area, however, full marine traffic surveys (including the use of radar) will be undertaken to more effectively map their intensity. Most of the activity recorded is along the offshore ECC, near to where it makes landfall. Further details of commercial fishing activity are presented within Chapter 6.8 Commercial Fisheries.

6.9.3.7 The activities of tugs and other support vessels are presented in Figure 6-48. The principal activity near to Hornsea Four are those vessels engaged in the oil and gas industry. In particular, offshore supply vessels are active at the fields located near to the study area and pass through the Hornsea Four array area. The Babbage and Ravenspurn gas fields are located adjacent to the southwestern corner of the Hornsea Four array area. The Hyde and West Sole gas fields are located to the south and the Garrow and Kilmar gas fields to the north. Significant activity by these vessels was also recorded across the offshore limits of the offshore ECC.

6.9.3.8 There are no military Practice and Exercise Areas, aggregate extraction license areas, pilot boarding stations and IMO traffic schemes within the study area.

6.9.3.9 Search and Rescue (SAR) near to Hornsea Four is coordinated from Humber Coastguard. The Humber SAR helicopter base and the Royal National Lifeboat Institute (RNLI) all-weather lifeboats based in Humber/Cromer are the most likely assets to be deployed for an incident at Hornsea Four.

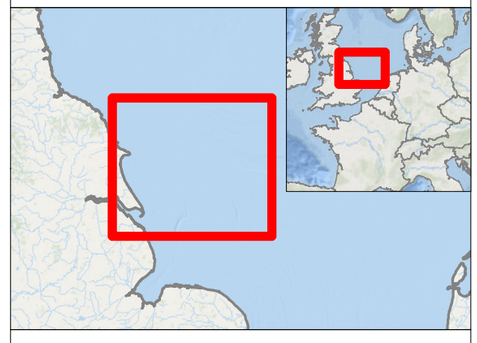
6.9.3.10 Hornsea Four array area lies within part of the former Hornsea Zone, with the preceding three wind farms (Hornsea Project One, Hornsea Project Two and Hornsea Project Three) at various stages of development. There is therefore likely to be a cumulative impact on shipping and navigation receptors when all of these projects are considered collectively. In addition, the Humber Gateway and Westermost Rough wind farms are also operational near to the offshore ECC.



Hornsea Four
Recreational Vessel Tracks
Figure 6.46

Scoping Boundary

Recreational Vessel Tracks



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Recreational Vessel Tracks
Document no: H4SR_SN05
Created by: AR
Checked by: RW
Approved by: JJH

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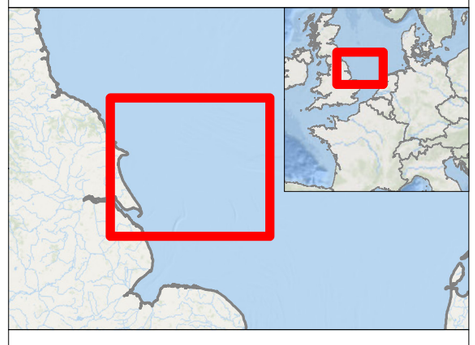
Hornsea Four
Fishing Vessel Tracks
Figure 6.47

Scoping Boundary

Fishing Vessel Tracks



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Fishing Vessel Tracks
Document no: H4SR_SN06
Created by: AR
Checked by: RW
Approved by: JJH

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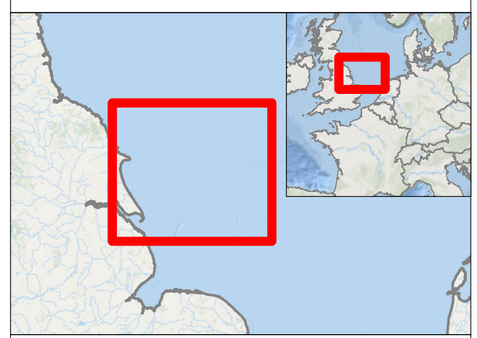
Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
AIS Data Provided by Ultramap

Date: 02/10/2018 Author: AR Name: H4SR_SN06_FishingTracks_A3Land_ETRS89

Hornsea Four
Tug and Service Vessel Tracks
Figure 6.48

Scoping Boundary

Tug and Service Vessel Tracks



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Tug and Service Vessel Tracks
Document no: H4SR_SN07
Created by: AR
Checked by: RW
Approved by: JJH

MARICO MARINE

Ørsted

Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Date: 02/10/2018 Author: AR Name: H4SR_SN07_TugServiceTracks_A3Land_ETRS89

300000 350000 400000

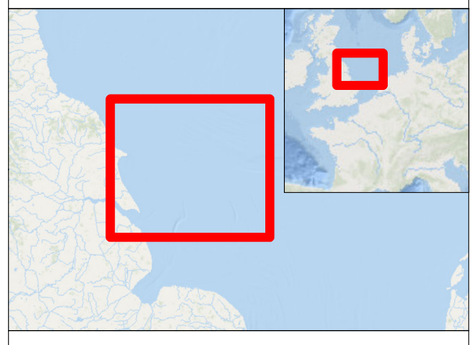
6050000 6000000 5950000

Incidents in the Study Area

6.9.3.11 Incident data from the Marine Accident Investigation Branch (MAIB) shows few significant incidents near to the Hornsea Four array area (see **Figure 6-49**). Within 10 NM, there were 22 unique incidents between 1997 and 2015. Only one of these was a navigational incident, a contact between an offshore supply vessel and an oil and gas field. Two near misses were reported, firstly between a naval vessel and a fishing vessel and secondly between a cargo vessel and a fishing vessel. The majority of incidents involve vessels working in the oil and gas industry and are accidents to persons, fires or mechanical failure / loss of control.

Hornsea Four
Marine Accident Investigation Branch Incident Data (1997-2015)
Figure 6.49

- Scoping Boundary
- Study Area
- Other Incident Types
- Accident to Person
- Capsize/Flooding/Foundering
- Collision
- Contact
- Grounding
- Hazardous Incident
- Mechanical Failure / Loss of Control



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

Marine Accident Investigation
Branch Incident Data (1997-2015)
Document no: H4SR_SN08
Created by: AR
Checked by: RW
Approved by: JJH

MARICO MARINE

Ørsted

Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
Incident Data provided by Marine Accident Investigation Branch

Date: 02-Oct-18 Author: AR Name: H4SR_SN08_Incidents_A3Land_ETRS89

300000 350000 400000

6050000 6000000 5950000

Summary and Key Issues

6.9.3.12 Following a review of the collected AIS data, the key shipping and navigation activities, which may be impacted by Hornsea Four, are:

- large commercial shipping (cargo/tankers) en-route to/from the Humber;
- Newcastle to Amsterdam ferry route;
- fishing activity in the Hornsea Four array area and close to the offshore ECC;
- inshore recreational activity near the offshore ECC;
- anchored commercial vessels near Flamborough Head;
- oil and gas activity to the west of the Hornsea Four array area and across the offshore ECC;
- cumulative impacts with other offshore wind developments;
- impact on SAR within and near to the Hornsea Four array area; and
- impacts on the use of radar, navigation aids and communications equipment.

6.9.4 Project Basis for Scoping Assessment

6.9.4.1 The shipping and navigation scoping assessment is based on the following maximum design scenario:

- the Hornsea Four array area of 846 km^2, 65 km from shore in water depths of 24 to 63 m;
- the construction of up to 180 WTGs of up to 305 m diameter, with a minimum rotor lower tip height of 35 m LAT;
- the construction of up to ten offshore platforms within the array area on gravity base structure foundations with associated seabed preparation and scour protection;
- the construction of six offshore export cables, inter-array cables, up to 13 interconnector cables and associated cable protection;
- the construction of up to three offshore HVAC booster substations within the offshore ECC;
- the regular maintenance of the structures through the project life; and
- decommissioning of the site to remove all offshore structures above the seabed.

6.9.4.2 For full design specification please refer to **section 3** Project Description of the Scoping Report. The basis for this assessment also includes the embedded mitigation (detailed in **section 6.9.5** below) where appropriate.

6.9.5 Embedded Mitigation

6.9.5.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed to reduce the potential for impacts on shipping and navigation. These are presented in **Table 6-35**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into

the assessment process and updated in the impacts register which is presented in full in Annex A.

6.9.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in section 6.9.6 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 6-35 – Relevant Shipping and Navigation Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co81	Primary: A scour protection layer (typically rock) may be needed where cable burial depths cannot be obtained.	Secured in the dMLs through the requirement for a SPMP and CSIP.
Co83	Primary: Undertake a cable burial risk assessment to inform front-end engineering works. Cable burial will be the preferred option for cable protection.	Secured in the dMLs through the requirement for a CSIP.
Co84	Primary: Foundations and cable routes will be micro-sited around qualifying sensitive habitat features (subject to agreement with the MMO) to an extent not resulting in a hazard for marine traffic and Search & Rescue capability. Presence of sensitive habitats will be identified through a review of the latest available benthic datasets and pre-construction surveys.	Secured in the dMLs through the requirement for a Design Plan.
Co89	Tertiary: Advance warning and accurate location details of construction/maintenance/decommissioning operations and associated Safety Zones and advisory safety distances will be given to fishing fleets (including via Notices to Mariners and Kingfisher Bulletins).	Secured in the dMLs through the requirements for notifications.
Co91	Tertiary: Guard vessels will be used, where appropriate, during construction/maintenance/decommissioning operations to ensure communication of and adherence to Safety Zones and advisory safety distances.	Secured in the dMLs through the requirement for a CMS and through the application for Safety Zones.
Co92	Tertiary: All infrastructure (including partially constructed/decommissioned) will be designed, marked and lit in accordance with standard industry guidance including MGN 543 and as advised by IALA and Trinity House.	Secured in the dMLs through the requirement for an ANMP.
Co93	Tertiary: Aids to navigation will be deployed in accordance with standard industry guidance.	Secured in the dMLs through the requirement for an ANMP.
Co94	Tertiary: Notifications will be made to the relevant bodies (e.g. United Kingdom Hydrographic Office) to allow marking of all installed infrastructure on charts.	Secured in the dMLs through the requirements for notifications.
Co96	Primary: Maintaining at least one line of symmetry/orientation in turbine layout	Secured in the dMLs through the requirement for a Design Plan.

Commitment ID	Measure Proposed	How the Measure will be Secured
Co98	Tertiary: Construction monitoring and coordination for project vessels.	Secured in the dMLs through the requirement for construction vessel traffic monitoring.
Co99	Tertiary: Development of Emergency Response and Cooperation Plan (ERCOP)	Secured in the dML through the requirement for an ERCoP.
Co101	Primary: Air draught clearance of blades greater than 22 m MHWS 23,8m MSL	Secured in the dMLs through the requirement for a Design Plan.
Co139	Tertiary: Application and use of safety zones of up to 500 m during construction/maintenance and decommissioning phases.	Secured by the application for Safety Zones prior to the commencement of construction.

6.9.6 Likely Significant Effects

6.9.6.1 Table 6-36 sets out an assessment of effects on shipping and navigation at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.9.6.2 The assessment presented in Table 6-36 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 6-35, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for shipping and navigation effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified shipping and navigation practitioners.

6.9.6.3 Table 6-36 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.9.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 6-36 - Likely Effects - Shipping and Navigation

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction/Decommissioning phases: Increased collision risk - presence of wind farm construction traffic increases the risk of collision between navigating vessels	Tertiary Co98 Co99 Co91	Moderate	Medium	**Likely significant effect without secondary mitigation** The additional construction traffic increases the likelihood of encounters. The impacts will most likely involve project vessels, with a lesser impact on other navigating vessels.	Scoped In A detailed assessment will be undertaken using analysis, consultation and collision risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Collision risk modelling Incident analysis Consultation
Construction/Decommissioning phases: Increased contact risk - presence of wind warm construction traffic increases the risk of contact between navigating vessels and array structures	Tertiary Co92 Co60 Co96 Co101 Co97 Co89 Co139 Co99 Co91	Moderate	Medium	**Likely significant effect without secondary mitigation** Additional structures which have not been fully commissioned increases risk of contact with project and transiting vessels.	Scoped In A detailed assessment will be undertaken using analysis, consultation and contact risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Contact risk modelling Incident analysis Consultation
Construction/Decommissioning phases: Impact on vessel routeing - array area causes deviations in shipping routes, increasing transit time.	Tertiary Co97 Co89	Moderate	Medium	**Likely significant effect without secondary mitigation** Deviations from shipping/ferry routes will result from the project. The increased distance travelled is not expected to be significant.	Scoped In A detailed assessment will be undertaken using analysis, consultation and route modelling to inform the NRA.	AIS data (One Year) Radar traffic surveys Vessel route Modelling Consultation
Construction/Decommissioning phases: Impact on SAR - array diminishes emergency response capability	Tertiary Co92 Co96 Co99	Minor	Low	**Likely significant effect without secondary mitigation** SAR will still be functional during construction given the embedded mitigation in place.	Scoped In A simple assessment will be undertaken.	
Construction/Decommissioning phases: Impact on radar, communications and navigation equipment - array structures impact on the communications and navigation equipment of navigating vessels,	Tertiary Co92 Co60 Co96 Co97	Minor	Negligible	**Likely significant effect without secondary mitigation** Presence of turbines is not expected to have a significant effect on a vessel's equipment.	Scoped In A simple assessment will be undertaken.	Desktop based impact assessment Consultation
Construction/Decommissioning phases: Impact on recreational activity - construction activities and array	Tertiary Co97 Co89 Co139	Negligible	Low	**Likely significant effect without secondary mitigation** Limited recreational activity in array area, impact is most likely	Scoped In A simple assessment will be undertaken.	AIS data (one year) Radar traffic surveys

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
structures adversely affect the activities of recreational users.	Co99 Co60 Co101			during cable laying inshore of the offshore ECC.		Vessel route modelling Consultation
Construction/Decommissioning phases: Impact on fishing activity - construction activities and array structures adversely affect the activities of fishing users.	Tertiary Co97 Co89 Co139 Co99 Co60 Co101	Moderate	Low	**Likely significant effect without secondary mitigation** Periodic fishing activity in array area, impact is most likely during cable laying inshore of the offshore ECC	Scoped In A simple assessment will be undertaken.	Consultation Latest VMS/fisheries survey data
Construction/Decommissioning phases: Impact on Oil and Gas activity - construction activities and array structures adversely affect the activities of the oil and gas industry.	Tertiary Co97 Co89 Co139 Co99 Co60 Co101	Moderate	Low	**Likely significant effect without secondary mitigation** Oil and gas activity is principally clear of the array area, reducing the level of significance.	Scoped In A simple assessment will be undertaken.	
Construction/Decommissioning phases: Impact during cable laying - cable laying activities causes disruption and collision risk with other navigating vessels,	Tertiary Co139 Co98 Co99 Co100 Co91	Minor	Low	**Likely significant effect without secondary mitigation** Short duration of cable laying activities reduces the level of impact on other receptors.	Scoped In A simple assessment will be undertaken.	
Construction/Decommissioning phases: Anchor snagging risk with cable - partially constructed cable is snagged by a vessel anchor.	Tertiary Co139 Co98 Co99 Co100 Co91	Negligible	Medium	**Likely significant effect without secondary mitigation** Sparse anchoring in the study area reduces the likelihood of occurrence.	Scoped In A simple assessment will be undertaken.	
Construction/Decommissioning phases: Fishing gear snagging risk with cable - partially constructed cable is snagged by fishing gear.	Tertiary Co139 Co98 Co99 Co100 Co91	Minor	Medium	**Likely significant effect without secondary mitigation** Partially protected cable is vulnerable to snagging for a short period of time.	Scoped In A simple assessment will be undertaken.	
Construction/Decommissioning phases: Reduction in navigable depth - construction of the cable route reduces the navigable depth for vessel traffic.	Tertiary Co97 Co139 Co100 Co91	Negligible	Low	**Likely significant effect without secondary mitigation** Depths of water are generally significant and therefore no impact anticipated during project.	Scoped In A simple assessment will be undertaken.	Cable protection criteria.
Construction/Decommissioning phases: Contact risk with cable substation - construction of the substation	Tertiary Co92 Co60 Co97	Moderate	Medium	**Likely significant effect without secondary mitigation**	Scoped In A detailed assessment will be undertaken using	AIS data (one year) Radar traffic surveys

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
increases contact risk with the structures.	Co89 Co139 Co99 Co91			Isolated structure not fully commissioned will be located in a dense area of traffic.	analysis, consultation and contact risk modelling to inform the NRA.	Contact risk modelling Incident analysis Consultation
Operational phase: Increased collision risk - presence of wind farm maintenance traffic increases the risk of collision between navigating vessels	Tertiary Co93 Co94 Co99	Minor	Medium	**Likely significant effect without secondary mitigation** Deviation of vessels could lead to increased collision risk, although given the available open waters this is not likely to be significant.	Scoped In A simple assessment will be undertaken to inform the NRA.	AIS data (one year) Radar traffic surveys Incident analysis Consultation
Operational phase: Increased contact risk - presence of wind Farm maintenance traffic increases the risk of contact between navigating vessels (including associated wind farm vessels) and array structures	Tertiary Co92 Co93 Co94 Co60 Co96 Co101 Co97 Co89 Co98 Co99 Co91	Minor	Medium	**Likely significant effect without secondary mitigation** Vessels will divert around the array with little transiting through.	Scoped In A detailed assessment will be undertaken using analysis, consultation and contact risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Contact risk modelling Incident analysis Consultation
Operational phase: Impact on Vessel routeing - array area causes deviations in shipping routes, possibly increasing vessel transit time.	Tertiary Co97 Co89	Moderate	Medium	**Likely significant effect without secondary mitigation** Deviations from shipping/ferry routes will result from the project. The increased distance travelled is not expected to be significant.	Scoped In A detailed assessment will be undertaken using analysis, consultation and route modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Vessel route modelling Consultation
Operational phase: Impact on SAR - array diminishes emergency response capability.	Tertiary Co84 Co92 Co96 Co99	Minor	Low	**Likely significant effect without secondary mitigation** SAR will still be functional during operation given the embedded mitigation in place.	Scoped In A simple assessment will be undertaken.	
Operational phase: Impact on radar, communications and navigation equipment - array structures impact on the communications and navigation equipment of navigating vessels,	Tertiary Co92 Co60 Co96 Co97	Minor	Negligible	**Likely significant effect without secondary mitigation** Presence of turbines is not expected to have a significant effect on a vessel's equipment.	Scoped In A simple assessment will be undertaken.	Desktop based impact assessment Consultation
Operational phase: Impact on recreational activity - maintenance activities and array structures adversely affect the activities of recreational users.	Tertiary Co97 Co89 Co99 Co60	Negligible	Low	**Likely significant effect without secondary mitigation** Limited recreational activity in array area, impact is most likely inshore of the cable route.	Scoped In A simple assessment will be undertaken.	AIS data (one year) Radar traffic surveys Vessel route

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
	Co101					modelling Consultation
Operational phase: Impact on fishing activity - maintenance activities and array structures adversely affect the activities of fishing users.	Tertiary Co97 Co89 Co99 Co60 Co101	Moderate	Low	**Likely significant effect without secondary mitigation** Periodic fishing activity in array area, impact is most likely during cable laying inshore of the cable route.	Scoped In A simple assessment will be undertaken.	Consultation Latest VMS/fisheries survey data
Operational phase: Impact on Oil and Gas activity - maintenance activities and array structures adversely affect the activities of the oil and gas industry.	Tertiary Co97 Co89 Co99 Co60 Co101	Moderate	Low	**Likely significant effect without secondary mitigation** Oil and gas activity is principally clear of the array area, reducing the level of significance.	Scoped In A simple assessment will be undertaken.	
Operational phase: Anchor snagging risk with cable - cable is snagged by a vessel anchor.	Tertiary Co81 Co83 Co99 Co100	Negligible	Medium	**Likely significant effect without secondary mitigation** Sparse anchoring in the study area reduces the likelihood of occurrence.	Scoped In A simple assessment will be undertaken.	
Operational phase: Fishing gear snagging risk with cable - cable is snagged by fishing gear.	Tertiary Co81 Co83 Co97 Co89 Co99 Co100	Minor	Medium	**Likely significant effect without secondary mitigation** Fishing along the cable route could lead to snagging.	Scoped In A simple assessment will be undertaken.	
Operational phase: Reduction in navigable depth – cable/protection reduces the navigable depth for vessel traffic.	Tertiary Co83 Co97 Co100	Negligible	Low	**Likely significant effect without secondary mitigation** Depths of water are generally significant and therefore no impact anticipated during project.	Scoped In A simple assessment will be undertaken.	Cable protection criteria
Operational phase: Contact risk with cable substation - the substation increases contact risk with the structures.	Tertiary Co92 Co60 Co97 Co89 Co99 Co91	Moderate	Medium	**Likely significant effect without secondary mitigation** Isolated structure not fully commissioned will be located in a dense area of traffic.	Scoped In A detailed assessment will be undertaken using analysis, consultation and contact risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Contact risk modelling Incident analysis Consultation

6.9.7 Proposed Approach to the PEIR and ES

6.9.7.1 The shipping and navigation assessment will consist of several steps which are principally based on the MCA's MGN 543 (M+F) guidance document and former Department of Energy and Climate Change (DECC) 'Methodology for Assessing the Navigational Safety Risks of Offshore Renewable Energy Installations (OREIs)' (subsequently published by the MCA).

6.9.7.2 Additional guidance will be sought from the MCA MGN 372 'Guidance to Mariners Operating in the Vicinity of UK OREIs', the RYA 'Position on Offshore Energy Developments: Paper 1 – Wind Energy' and IALA 'O-117 the Marking of Offshore Wind Farms'.

6.9.7.3 A NRA will be produced in parallel to the Impact Assessment following the IMO Formal Safety Approach.

6.9.7.4 Consultation will be undertaken with key shipping and navigation stakeholders during the PEIR and NRA. Meetings will be arranged with key consultees and other identified stakeholders contacted by telephone and email where appropriate. The consultation will seek to better understand the activities and possible level of impact the project would have upon their activities. The list of consultees will likely include:

- MCA;
- Trinity House;
- Chamber of Shipping;
- RNLI;
- RYA;
- Local yacht clubs;
- Local fishing organisations; and
- Commercial operators (e.g. ferries, oil and gas vessels) regularly using area.

6.9.7.5 A vessel traffic survey will be undertaken to the standard of MGN 543. The survey will consist of 28 days of seasonal data (two x 14 day surveys) collected from a vessel-based survey using AIS, radar and visual observations to capture all vessels navigating in the study area. A winter 2018/2019 and summer 2019 survey campaigns are proposed for inclusion in this assessment.

6.9.7.6 Through a review of the information gathered, vessel traffic analysis and consultation, an NRA will be produced utilising the Formal Safety Assessment approach. Hazards will be identified that relate to the construction, operation and decommissioning of the project, the likelihood and consequence of those hazards will be scored and appropriate risk controls will be identified.

6.9.8 Scoping Questions for Consultees

6.9.8.1 Scoping questions for consultees in relation to shipping and navigation include:

1. Have all impacts to shipping and navigation from Hornsea Four been identified?
2. Is the study area sufficient to capture wider impacts to shipping receptors?
3. Have sufficient data sources been collected or identified upon which to base a comprehensive navigation assessment?
4. Have the embedded mitigation measures identified in this scoping study sufficiently mitigated the impact of Hornsea Four on shipping and navigation and is there any further mitigation that could be embedded?
5. Have all appropriate consultees been identified?

6. Do the NRA methods outlined above ensure a comprehensive assessment of the impacts on shipping and navigation?

6.10 Aviation and Radar

6.10.1 Introduction

6.10.1.1 This section of the Scoping Report characterises the potential interactions of aviation and radar infrastructure and operation with respect to the Hornsea Four array area and offshore ECC by considering the proximity to and operations of airports, the types of radar systems providing radar coverage off the UK East Coast, helicopter and Ministry of Defence (MOD) operations. The potential effects arising from the construction, operation (including maintenance) and decommissioning of the offshore components of Hornsea Four on these activities are considered.

6.10.1.2 Military Practice and Exercise Areas (PEXA) (non-radar related) and communications (including subsea communication cables and oil and gas platform radar early warning systems (REWS)) are addressed separately within **section 6.12** Infrastructure and Other Users.

6.10.2 Study Area

6.10.2.1 The aviation and radar study area includes all existing aviation and radar receptors that might be potentially affected by Hornsea Four. This area has been defined as the Hornsea Four array area, the offshore ECC and the following specific receptors / areas within the wider southern North Sea region:

- Radars near the eastern coast of England that could potentially detect 370 m high (blade tip) Wind Turbine Generators (WTGs) within the array area;
- Military Low Flying Operations;
- Offshore helicopter flight operations including Helicopter Main Routes (HMR) operating within the proximity of the array area;
- Offshore oil and gas platforms that are located within a 9 NM consultation buffer that overlap with the array area; and
- Search and Rescue (SAR) flight operations.

6.10.3 Baseline Environment

Data Sources used for Scoping

6.10.3.1 A variety of civil aviation publications contain information and guidance relating to the potential effects of an offshore wind development on aviation stakeholders, including radar system operators, airport operators and operators in the offshore environment. The documents detailed in **Table 6-37** will inform the desk-based study of potential impacts of the assessment:

Table 6-37 - Key Sources of Aviation and Radar Data

Source	Summary	Coverage of Hornsea Four array area and ECC
Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 168 (CAA, 2014)	Licensing of Aerodromes sets out the standards required at UK licensed aerodromes relating to its management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids.	N/A

Source	Summary	Coverage of Hornsea Four array area and ECC
CAP 393: The Air Navigation Order 2016 and Regulations (CAA, 2018a);	Sets out the provisions of the Air Navigation Order as amended together with regulations made under the Order. It is prepared for those concerned with day-to-day matters relating to air navigation that require an up-to-date version of the air navigation regulations and is edited by the Legal Advisers Department of the CAA. CAP 393 also includes application of lighting to WTGs in UK territorial waters.	N/A
CAP 437: Standards for Offshore Helicopter Landing Areas (CAA, 2016)	Guidance on Standards provides the criteria applied by the CAA in assessing helicopter landing areas for worldwide use by helicopters registered in the UK. It includes design of winching area arrangements located on WTG platforms to represent current best practice.	N/A
CAP 764: Policy and Guidelines on Wind Turbines (CAA, 2016a)	Provides assistance to aviation stakeholders to help understand and address wind energy related issues, thereby ensuring greater consistency in the consideration of the potential impact of proposed wind farm developments.	N/A
CAP 670: Air Traffic Services Safety Requirements (CAA, 2014a)	Sets out the safety regulatory framework and requirements associated with the provision of an air traffic service.	N/A
Military Aeronautical Information Publication (Mil AIP) (MOD, 2018)	Is the main resource for information and flight procedures at all military aerodromes.	N/A
CAA, CAP 032: UK Integrated Aeronautical Information Package (UKIAIP) (CAA, 2018)	Is the main resource for information and flight procedures at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information.	N/A
Maritime and Coastguard Agency (MCA) Maritime Guidance Notes (MGN) 543: Safety of Navigation Offshore Renewable Energy Installations (OREIs) (MCA, 2016)	Guidance on UK Navigational Practice, Safety and Emergency Response contains information for operators and developers in formulating their emergency response plans and site safety management.	N/A

Overview of Baseline Environment

6.10.3.2 The airspace above the Hornsea Four array area is used by civil and military aircraft, which can be tracked by radar systems operated by civil airports, NATS Holdings (NATS; formerly National Air Traffic Services Ltd) and the MOD. Airspace and air traffic surveillance, communication and management infrastructure is comprised of the following systems, which may be affected by WTGs:

- Primary Surveillance Radar (PSR);
- Secondary Surveillance Radar (SSR);
- Air Defence Radar (ADR);
- Meteorological Radar; and
- Other Aeronautical Communication and Navigation Systems (CNS).

6.10.3.3 **Figure 6-50** shows the location of radar stations and airports in the vicinity of Hornsea Four. The analysis of the potential effect on these systems is based on an aviation operational risk assessment referencing all relevant operational and safety regulations. Radar performance and propagation modelling will be carried out to determine the potential detection of proposed turbines in the array area from civil and military radar infrastructure.

Hornsea Four
Radar Stations
Figure 6.50

250000 300000 350000 400000

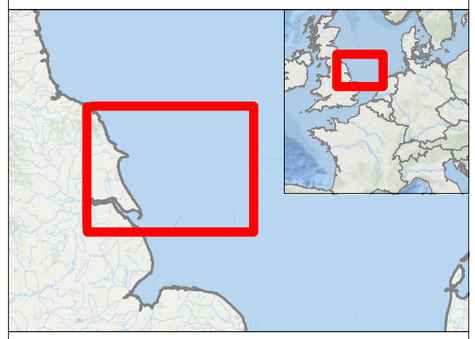
6050000 6000000 5950000

N
GRID NORTH

Humberside Airport

Claxby Primary Surveillance Radar

- Scoping Boundary
- Array Area
- Civil Airports
- National Air Traffic Services
- National Air Traffic Services Safeguarding 200m Tip Height Consultation Range



Coordinate system: WGS 1984 UTM Zone 31N

Scale@A3: 1:653000

0 4 8 16 24 32 Kilometres

0 2 4 8 12 Nautical Miles

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Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Date: 01/10/2018 Author: laurastally Name: H4SR_AR01_Radar_Stations_A3Land_ETRS89

Radar Stations
Document no: H4SR_AR01
Created by: RM
Checked by: CC
Approved by: LK

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6.10.3.4 The potential impacts on these systems will be fully considered in the analysis process. It should be noted however that even if a clear radar line-of-sight is found between WTGs within the Hornsea Four array area and a radar system, this does not necessarily mean that the offshore wind farm will cause interference to the provision of the service the radar operator provides. Consultation with the radar operator will be undertaken on this issue where required.

6.10.3.5 Desk based studies will potentially identify an effect on the following aviation and radar Stakeholders:

- Civil En-route operations;
- Civil Airport Air Traffic Control (ATC) operations;
- MOD ATC operations;
- MOD Air Defence (AD) operations and training;
- Helicopter support to offshore Oil & Gas Industry operations; and
- SAR flight operations.

MOD Air Defence Radar (ADR)

6.10.3.6 The nearest ADR systems to Hornsea Four are the TPS77 type radar located at RAF Brizlee Wood in Northumberland and RAF Trimingham in North Norfolk. The Hornsea Four array area is considered to be potentially within radar line of sight coverage and detectable by these systems.

6.10.3.7 Any identified effect of WTG induced radar clutter on the ADR systems that serve the airspace above the Hornsea Four array area would potentially reduce the capability of UK Air Defence.

6.10.3.8 WTG in coverage areas of ADR systems could shield the radar from genuine targets of interest in clutter. Furthermore, a degree of 'shadowing' could be created behind detectable WTGs. These individual potential effects could impact on the ability of Air Defence Controllers to provide a safe and efficient service to aircraft and successfully utilise the radar data to monitor and intercept potential airborne threats to UK airspace.

6.10.3.9 The Lockheed Martin TPS-77 ADR systems, in operation at Brizlee Wood and Trimingham, are the only current ADR systems that have inherent hardware and software mitigations for the effects of WTG which have previously been accepted by the MOD. The mitigation principle uses the concept of Non Automatic Initiation Zones (NAIZ). A NAIZ prevents the radar from automatically creating tracks from any targets that originate within a NAIZ. The MOD has paused the receipt and assessment of any mitigation submissions relating to TPS-77 radars and multi turbine wind farms. Further upgrades to the TPS-77 radar software are being scoped and it is hoped that this will improve the situation.

6.10.3.10 MOD engagement would establish the potential effects of Hornsea Four on the systems although these are likely to be significant should the proposed development be detectable by these individual systems, consultation with the MOD will be continued to understand the impacts and to develop a suitable means of mitigation.

NATS Primary Surveillance Radar (PSR)

6.10.3.11 The nearest NATS operated PSR systems to Hornsea Four are the ASR-23 type radar located at Claxby in North Lincolnshire and the ASR-10 radar located at Cromer in North

Norfolk. The majority of Hornsea Four array area is considered to be potentially within radar line of sight coverage and detectable by these systems.

6.10.3.12 Any identified effect of WTG induced radar clutter on these PSR systems that serve the airspace above the Hornsea Four array area would potentially reduce NATS capability.

6.10.3.13 Similar to ADR systems, WTG in coverage areas of NATS PSR systems could shield the radar from genuine targets of interest in clutter and a degree of 'shadowing' could be created behind detectable WTGs. Any of these potential effects could impact on the NATS provision of Air Traffic Services (ATS) to aircraft.

6.10.3.14 Engagement with NATS will establish what effects Hornsea Four could have on the Claxby and Cromer PSR systems and understand what technical and operational mitigation capability is available.

Helicopter Main Routes (HMR)

6.10.3.15 Offshore oil and gas platforms are supported by a number of helicopter operators who ferry crews and supplies to platforms from the mainland. The routes taken by helicopters on flights to and from offshore oil and gas platforms may follow HMR which form a network of corridors between offshore platforms and the main support bases at Norwich Airport and Humberside Airport. There are a number of HMR in the vicinity of the Hornsea Four array area although the use of these routes are not mandatory, helicopters routinely transit on a direct routing to their destination point; therefore, consultation with helicopter operators and the Air Navigation Service Provider (ANSP) would establish the HMR requirements within the Hornsea Four array area.

6.10.3.16 CAP 764 states that whilst HMRs have no defined lateral dimensions, they provide a network of offshore routes utilised by civilian helicopters. There should be no obstacles within 2 NM either side of HMRs but where planned these should be consulted upon with the helicopter operators and the ANSP. It may be considered that some WTG development within 2 NM of the route centreline could be manageable. However, a large number of WTG beneath an HMR could result in significant difficulties by forcing the aircraft to fly higher in order to maintain a safe vertical separation from obstructions.

Helicopter Operations to Offshore Oil & Gas Platforms

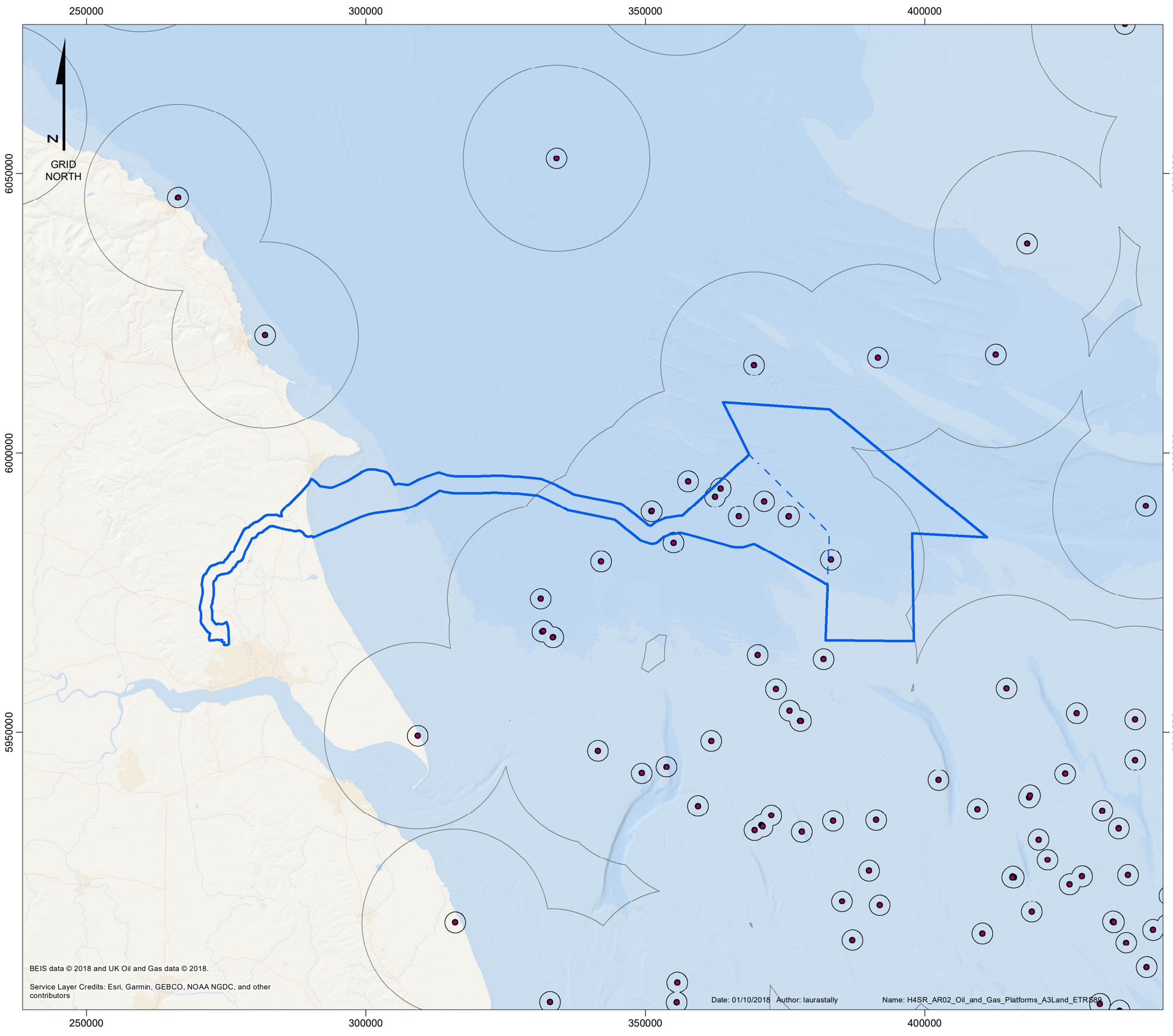
6.10.3.17 In order to help achieve a safe operating environment, a consultation zone of 9 NM radius around offshore helicopter installations is referenced in CAP 764. A number of platforms to the north and west of the Hornsea Four array area are assessed as being within the 9 NM consultation zone established for oil and gas platforms. It is necessary to understand the impact on continued safe flight to these platforms, including potential constraints on helicopter approach profiles.

6.10.3.18 The requirement of the 9 NM consultation zone is to promote consultation that would ensure adequate airspace in which helicopters can fly instrument approaches in poor weather conditions where a low visibility approach profile is needed. In addition, the consultation helps to ensure that helicopter pilots are able to safely carry out a Missed Approach Procedure from the platform (MAP) (CAA, 2016a).

6.10.3.19 WTG may be considered as physical obstructions and could infringe the minimum vertical obstacle clearance criteria of 1,000 feet (ft) on approach or departure from a

platform. Furthermore, during the approach to an offshore installation, all radar contacts (including radar contacts that are WTGs) must be avoided laterally by at least 1 NM. These combined effects within a 9 NM consultation zone of an offshore installation may impair the safety of air operations in poor weather conditions to that installation and affect the installation operators' regulatory requirements with regard to safety of operations. **Figure 6-51** shows the location of oil and gas platforms in the vicinity of Hornsea Four with the aforementioned 1 NM and 9 NM buffers.

Hornsea Four
Oil and Gas Platforms
Figure 6.51



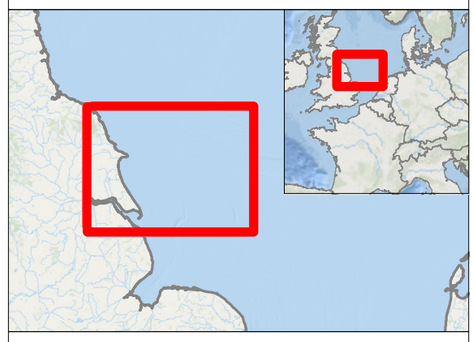
Scoping Boundary

Array

Oil and Gas Surface Infrastructure

1 nm Buffer Around Surface

9 nm Buffer Around Surfance



Coordinate system: WGS 1984 UTM Zone 31N

Scale@A3: 1:653000

0 3.25 6.5 13 19.5 26 32.5 Kilometres

0 2 4 8 12 Nautical Miles

Oil and Gas Platforms
Document no: H4SR_AR02
Created by: RM
Checked by: CC
Approved by: LK

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SAR Flight Operations

6.10.3.20 WTGs and their commissioning/decommissioning infrastructure may present a physical obstruction and affect SAR helicopter flight operations. The development will lead to a change of the operating environment should airborne SAR operations be required within or close to the array area.

Military Low Flying

6.10.3.21 The UK Low Flying System, used for Military Low Flying activity, covers the open airspace over the entire UK land mass and surrounding sea areas generally out to 2 NM from the coastline, from the surface to 2,000 ft. above mean sea level (amsl) however, military low flying does take place over the sea further than 2 NM from the coastline. Infrastructure within the Hornsea Four array area could therefore affect routine Military Low Flying activity.

Meteorological Radar Systems

6.10.3.22 In general terms, the blockage of a weather radar beam by any obstruction could result in a weather radar not being able to perform its intended purpose, namely to monitor rain (or snow) fall and wind. Even partial blockages have the potential to result in errors in the estimated precipitation.

6.10.3.23 The Statement of the European Union Meteorological Network OPERA Group (Operational Programme for the Exchange of weather Radar information), on the cohabitation between weather radars and wind turbines states that the deployment of turbines within 5 kilometres (km) of weather radar be prohibited. In addition, an impact study should be completed on turbines planned between 5 km and 20 km from UK Met Office radar (EUMETNET, 2006). There are no Met Office radar systems within 20 km of the Hornsea Four array area; therefore, Hornsea Four array area will not affect Met Office radar systems.

Other Aeronautical CNS

6.10.3.24 Aviation stakeholders should be consulted when a Local Planning Authority receive wind farm development proposals within a minimum radius of 20 km from an aviation related CNS facility. The radius may extend to a radius of 34 km for Instrument Landing System (ILS), which is used as a precision approach system for approaches to runways (CAA, 2014a). There are no aeronautical CNS installations within 34 km of the Hornsea Four array area; consequently, other CNS systems will not be affected by the proposed development and are therefore scoped out from further analysis.

6.10.4 Summary and Key Issues

6.10.4.1 The key aviation, radar and military receptors present across the Hornsea Four array area are:

- ADR systems located at RAF Brizlee Wood and RAF Trimingham.
- NATS operated PSR systems located at Claxby in North Lincolnshire (ASR-23 radar) and at Cromer in North Norfolk (ASR-10 radar).
- Helicopter main routes and operations to and from oil and gas platforms.
- Potential physical obstruction and affects upon SAR helicopter flight operations.

6.10.5 Project Basis for Scoping Assessment

6.10.5.1 The effects of wind turbines on aviation interests have been widely publicised but the primary concern is one of safety. There are innumerable subtleties in the actual effects but there are two dominant scenarios that lead to objection from aviation stakeholders:

- Physical obstruction. WTGs can present a physical obstruction to aircraft; and
- Impacts on radar and the provision of a radar-based Air Traffic Service (ATS). Wind turbine derived radar clutter[7] appearing on radar displays can affect the provision of an ATS to pilots. Radar clutter or false radar returns can confuse the air traffic controller in being unable to differentiate between aircraft and those radar returns provided by the detection of wind turbines. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from real aircraft away from the true aircraft position.

6.10.5.2 The Aviation and Radar scoping assessment considers the likely maximum design scenario of construction of up to 180 WTG at a maximum blade tip height of 370 m above Lowest Astronomical Tide (LAT) within the array area.

6.10.5.3 The basis for assessment also includes the embedded mitigation (detailed in **section 6.10.6** below) where appropriate.

6.10.6 Embedded Mitigation

6.10.6.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed to reduce the potential for impacts on aviation, radar and military. These are presented in **Table 6-38**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

6.10.6.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section 6.10.7** (i.e. the determination of magnitude of impact and significance of effect assumes implementation of these measures).

Table 6-38 – Relevant Aviation and Radar Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co99	Tertiary: Development of ERCOP	Secured in the dML through the requirement for an ERCoP.
Co102	Tertiary: Notification to aviation stakeholders of the location and height of all wind energy development and associated construction activities (all structures over 150 ft).	Secured in the dMLs through the requirements for notifications.
Co105	Tertiary: All structures (turbines and offshore support platforms) above 60 m in height to be fitted with aviation obstruction lighting.	Secured in the dMLs through the requirement for an ANMP.

[7] The term clutter refers to unwanted radar returns

Commitment ID	Measure Proposed	How the Measure will be Secured
Co106	Tertiary: Turbines to be accessed by hoist will be equipped with a helihoist status light on each turbine to indicate to a helicopter operator that the turbine blades and nacelle are safely secured in position prior to helicopter hoist operations commencing,	Secured in the dMLs through the requirement for an ANMP

6.10.7 Likely Significant Effects

6.10.7.1 Table 6-39 sets out an assessment of effects on aviation and radar at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.10.7.2 The assessment presented in Table 6-39 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 6-38, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for aviation and radar effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified aviation and radar practitioners.

6.10.7.3 Table 6-39 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.10.7.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 6-39 - Likely Effects - Aviation and Radar

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction phase: WTG effects on civil and military radar systems during construction process	None	Nil	Negligible	**No likely significant effect**	**Scoped Out**	None
Commissioning/Decommissioning phase: WTG and their commissioning / decommissioning infrastructure may present a physical obstruction and affect SAR helicopter flight operations. The development will lead to a change of the operating environment should an airborne SAR operation be required within or close to the array area.	Tertiary Co99 Co102 Co105	Minor	Low	**No likely significant effect**	**Scoped Out**	None
Operation phase: During operation WTG's in coverage areas of ADR systems could shield the radar from genuine targets of interest in WTG induced radar clutter. Furthermore, a degree of 'shadowing' could be created behind detectable WTG. Any of these potential effects could impact on the Air Defence Control ability to provide a safe and efficient service to aircraft and successfully utilise the radar data to monitor UK airspace from airborne threats.	None	Moderate	High	**Likely significant effect without secondary mitigation** Array area is potentially within the operational coverage of the Trimingham and Brizlee Wood ADR systems. WTG potentially detectable by ADR systems which would cause WTG induced radar clutter.	Scoped In A simple assessment will be completed. A radar line of sight (LOS) assessment will be completed to establish whether WTG parameters would be detectable by ADR systems. Consultation with the MOD will be required to understand operational impacts of potential detectability of WTG and to understand technical mitigation capability.	Final scheme design parameters for LOS analysis to establish the potential impacts on infrastructure and operations.
Operation phase: WTG in coverage areas of NATS PSR systems could shield the radar from genuine targets of interest in clutter and a degree of 'shadowing' could be created behind detectable WTG. Any of these potential effects could impact on the NATS provision of ATS to aircraft.	None	Moderate	Medium	**Likely significant effect without secondary mitigation** Array area is potentially within the operational coverage of the NATS Claxby and Cromer PSR systems. WTG potentially detectable by PSR systems.	Scoped In A simple assessment will be completed. A radar LOS assessment will be completed to establish whether WTG parameters will be detectable by these PSR systems. Consultation with the NATS will then be	Final scheme design parameters for LOS analysis. to establish the potential impacts on infrastructure and operations.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
					undertaken to understand operational impacts of potential detectability of WTG and to understand mitigation capability.	
Operation phase: Hornsea Four array area is considered as being within the 9 NM consultation zone established for the oil & gas platforms to the north and southwest of the array area.	None	Moderate	Medium	**Likely significant effect without secondary mitigation** It is necessary to understand the impact on safe flight to these platforms, including constraints on helicopter flight profiles to ensure that appropriate access to platforms is maintained.	Scoped In A simple assessment will be completed to develop constrained areas where WTG would inhibit helicopter operations.	Final scheme design parameters for analysis to establish the potential impacts on infrastructure and operations.
Operation phase: Offshore oil and gas platforms are supported by a number of helicopter operators who ferry crews and supplies to platforms from the mainland. The routes taken by helicopters on such flights may follow HMR which form a network of corridors between offshore platforms and the main support bases although these routes are not mandatory.	Tertiary Co102	Moderate	Medium	**Likely significant effect without secondary mitigation** A number of HMR routes are in proximity to the Hornsea Four array area. WTG and construction and decommissioning infrastructure may present physical obstruction impacts.	Scoped In A simple assessment will be completed to establish any physical obstructions that would inhibit helicopter operations.	Rochdale envelope parameters for analysis to establish the potential impacts on infrastructure and operations. .
Operation phase: Under aviation flight rules, the MSA is the altitude below which it is unsafe to fly in IMC (i.e. in poor visibility/cloud) owing to presence of terrain or obstacles within a specified area.	Tertiary Co102	Minor	Low	**No likely significant effect**	**Scoped Out**	None
Construction/Decommissioning phase: There is expected to be a requirement for Aviation Obstruction Lighting on the construction and decommissioning infrastructure and all or individual WTG based on CAA regulations. The fitting of appropriate lighting would ensure conspicuity of the	Tertiary Co99 Co102 Co105 Co106	Minor	Low	**No likely significant effect**	**Scoped Out**	None

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
WTG and infrastructure to stakeholders.						
Commissioning/Decommissioning phase: WTG commissioning / decommissioning infrastructure may present physical obstruction effects on civil and military flight operations (including military Low Flying activity).	Tertiary Co102 Co105	Minor	Low	**No likely significant effect**	**Scoped out**	None

6.10.8 Impacts Scoped Out of Assessment

WTG effects on civil and military radar systems (Construction)

6.10.8.1 During construction, and prior to commissioning WTG blades will not be rotational. As a result, the infrastructure will not be processed and presented onto RDDS by the radar system. Therefore, there will be no impacts on radar systems during the construction phase of the project.

Physical obstruction effects on civil and military flight operations (Construction and Decommissioning)

6.10.8.2 Civil and military flight operations, including SAR activity and military Low Flying activity could be impacted by additional obstacles in their area of flight operations; however, a range of CAA regulated mitigation measures, in the form of appropriate notification to aviation stakeholders, lighting and marking of WTG to minimise effects to aviation flight operations would apply to the development of the project (and are proposed as embedded mitigation).

6.10.8.3 Information on potential aviation obstructions will be promulgated to appropriate aviation agencies for marking on aeronautical related charts and in documentation. In addition, the development of an ERCoP will be compiled in conjunction with the MCA and will be in place for the construction, operation and decommissioning phases of the Project.

Aviation Obstruction Lighting requirements

6.10.8.4 There will be a requirement for Aviation Obstruction Lighting to be fitted on the construction and decommissioning infrastructure and all or individual WTG based on CAA regulations 9as set out in the embedded mitigation).

6.10.8.5 The fitting of appropriate lighting would ensure conspicuity of the WTG and infrastructure to aviation stakeholders operating in the vicinity of the proposed development. Consultation with relevant aviation stakeholders would be required to establish required lighting, and particularly to ensure aviation lighting is clearly distinguishable from maritime lighting.

6.10.9 Proposed Approach to the PEIR and ES

6.10.9.1 The PEIR will set out the following aspects in completing the aviation and radar assessment:

- overview of the effects of the WTGs on aviation, radar and military operations;
- further definition of the aviation baseline environment;
- brief details of the location, size and potential radar clutter footprint of Hornsea Four;
- summary of a desk-top LOS analysis for the prescribed 'Rochdale Envelope';
- technical impact of Hornsea Four on regional radar systems. This will include radar operated by the MOD, NATS and other aerodromes within the study area.
- operational Impact Assessment of Hornsea Four relevant to ATS and other aviation services associated with the affected radar stakeholders i.e. if the radar has line of sight to WTGs proposed for Hornsea Four, how will this impact on the provision of ATS;
- assessment of any impact on any other littoral airfields, helicopter landing areas, or other aviation stakeholders identified through scoping;

- consideration of the potential effects on the HMR within the study area;
- consideration and analysis of helicopter access constraints to existing oil & gas platforms within or in proximity to the Hornsea Four array area; and
- overview of anticipated effects during construction, operation and decommissioning phases of Hornsea Four, along with an overview of cumulative effects in respect of Hornsea zone projects and other wind energy projects (existing, planned and under construction).

6.10.10 Scoping Questions for Consultees

6.10.10.1 Scoping questions for consultees in relation to aviation and radar include

1. Do the relevant statutory aviation consultees agree with the baseline and the identification of infrastructure and operations for assessment?
2. Is there an impact pathway from Hornsea Four to your infrastructure or operations?
3. Are your infrastructure or operations sensitive to the potential impact that could arise from Hornsea Four?
4. Are the potential impacts likely to be on a scale that may result in significant effects to your infrastructure or operations?
5. Could the potential impacts contribute cumulatively with the impacts of other wind energy developments resulting in significant effects to your infrastructure or operations?
6. Is there a method of avoidance of impact or development of mitigation capability that would reduce the impacts on your infrastructure or operations to a level where significant effects would not occur?
7. Is there sufficient confidence in the avoidance of impacts or the development of mitigation capability in terms of deliverability to support Hornsea Four?

6.11 Seascape and Visual Resources

6.11.1 Introduction

6.11.1.1 This section of the Scoping Report identifies the offshore seascape and visual receptors of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components of Hornsea Four both individually and cumulatively on the seascape and visual resources (SVR).

6.11.1.2 The SVR EIA will consider all seascape and visual receptors seaward of MLWS where there is the potential for them to be significantly affected. Impacts on onshore landscape and visual receptors from the offshore components of Hornsea Four are considered within **section 7.4** (Landscape and Visual Assessment).

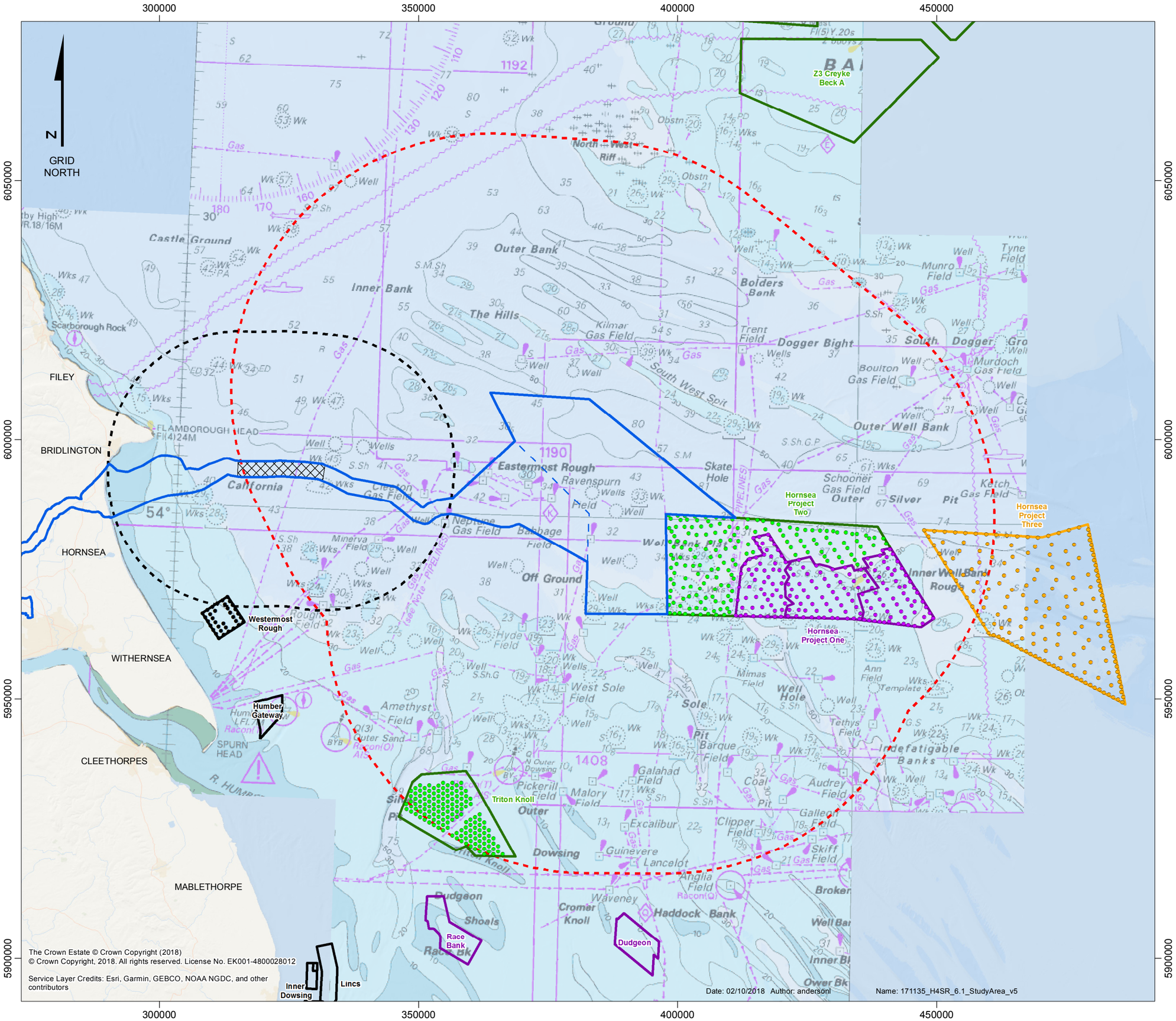
6.11.1.3 In relation to Hornsea Four, this SVR chapter includes more information than is usual at the scoping stage in order to provide further details about the likely effects of the proposals with the aim being to scope out SVR effects from requiring further assessment within the PEIR and ES.

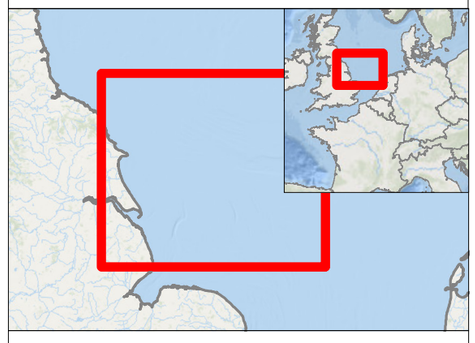
6.11.2 Study Area

6.11.2.1 The SVR assessment that covers the Hornsea Four components described in the Project Description (**section 3** of the Scoping Report) will assess the effects within the following study areas, which are illustrated on **Figure 6-52**, and summarised below.:

- **Hornsea Four array area** - 50 km radius study area from array area boundary and including the array area itself. This area has been defined with reference to Visual Representation of Wind Farms: Guidance - Version 2.2 (SNH, February 2017) which gives recommended initial Zone of Theoretical Visibility (ZTV) distances from the nearest turbine. The seascape and visual array study area is not intended to provide a boundary beyond which the operational Hornsea Four infrastructure located within the array area cannot be seen, however it is considered to be the maximum extent within which a significant seascape or visual effect could occur. The tallest turbines included in the SNH (2017) guidance is 150 m+ with a recommended initial ZTV radius of 45 km. Due to the larger maximum height of the turbines proposed in the Hornsea Four array area (maximum 370 m to tip) other offshore wind farm seascape, landscape and visual impact assessments (SLVIA) where taller turbines have been proposed, have been referred to. This is consistent with the study area agreed for the Hornsea Project Three ES, which was submitted in 2018. The recently prepared Thanet and East Anglia TWO offshore wind farm SLVIAs have agreed 45km and 50km radius study areas for turbines of a maximum height of 250m and 300m to tip, respectively.
- **Offshore ECC** – the area within which the cables may be located.
- **Offshore HVAC booster substations** – to include the area lying within a 25km buffer from the offshore HVAC booster substation search area. It is considered that whilst the offshore HVAC booster substations may be visible beyond this distance the effects would not be significant due to the large scale, simple sea context.
- **Historic Seascape Character (HSC)** – the study area for the effects on this particular seascape receptor have been defined as the area in which there would be a direct effect on HSC, namely those areas which include the Hornsea Four array area and offshore ECC. This approach is as agreed for the recently submitted Hornsea Project Three ES.

Hornsea Four
Study Areas and Offshore Cumulative Wind Farms
Figure 6.52





Hornsea Four

- Scoping Boundary
- Array Area
- HVAC Search Area

Study Area

- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Offshore Wind Farm Status:

- Active/In Operation
- Under Construction
- Consented
- Pre-planning Application

Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Study Areas and Offshore Cumulative Wind Farms
Document no: H4SR_SV01
Created by: LA
Checked by: LT
Approved by: LK

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Date: 02/10/2018 Author: andersonl

Name: 171135_H4SR_6.1_StudyArea_v5

6.11.3 Baseline Environment

Data Sources used for Scoping

6.11.3.1 A preliminary desk-based review of literature and data sources to support this Scoping Report has highlighted the data sources included in Table 6-40, which provide coverage of the Hornsea Four study areas.

Table 6-40 - Key sources of SVR data

Source	Summary	Coverage of Hornsea Four array area and offshore ECC
SeaZone Hydro View 1:75,000 raster and vector mapping	Base mapping and information for sea area.	Full coverage of Hornsea Four SVR study areas.
Marine Plan Areas (MPAs) Marine Management Organisation (MMO, 2014)	Provides mapping of Marine Plan Areas (MPAs) in England	Full coverage of Hornsea Four SVR study areas.
Seascape characterisation around the English Coast (Marine Plan Areas 3 and 4) (Natural England, 2012);	Pilot study that describes and defines areas based on their seascape characteristics at a national scale. Perceptual qualities information included.	Coverage of MPAs 3 and 4 which form the southern and eastern parts of the SVR study areas.
Seascape character area assessment for East Inshore and East Offshore marine plan areas (MMO, 2012);	Describes and defines areas based on their seascape characteristics at a national scale.	Coverage of MPAs 3 and 4 which form the southern and eastern parts of the SVR study areas.
MMO1134 Seascape Character Assessment for the North East Inshore and Offshore marine plan areas (MMO, September 2018).	Describes and defines areas based on their seascape characteristics at a national scale.	Coverage of MPAs 1 and 2 which form the northern and western parts of the SVR study areas.
HSC: Consolidating the National HSC Database. (Land Use Consultants (LUC), 2017);	Provides mapping and descriptions of the HSC types and sub-types across four sea levels.	Full coverage of Hornsea Four SVR study areas.
Recorded Visibility Data (Met Office, 2016) referenced from the Hornsea Project Three ES	Provides information about visibility offshore over a 10-year period.	Provides an insight across the offshore array area study area.
Hornsea Offshore Wind Farm Project Two ES (Smart Wind, 2015)	Provides baseline information on SRV receptors assessed.	Partial coverage of array area study area.
Hornsea Offshore Wind Farm Project Three ES (Orsted, 2018)	Provides baseline information on SRV receptors assessed.	Partial coverage of array area study area.

Overview of Baseline Environment

Seascape Resource - Present day National Seascape Character Areas (NSCAs)

6.11.3.2 The likely effects of Hornsea Four on present day seascape character and visual resources are considered within two SVR assessment study areas as follows:

- The Hornsea Four array area study area (hereafter referred to as the 'array SVR study area'); and
- The offshore HVAC booster substation search areas study area (hereafter referred to as the 'Booster Station SVR study area').

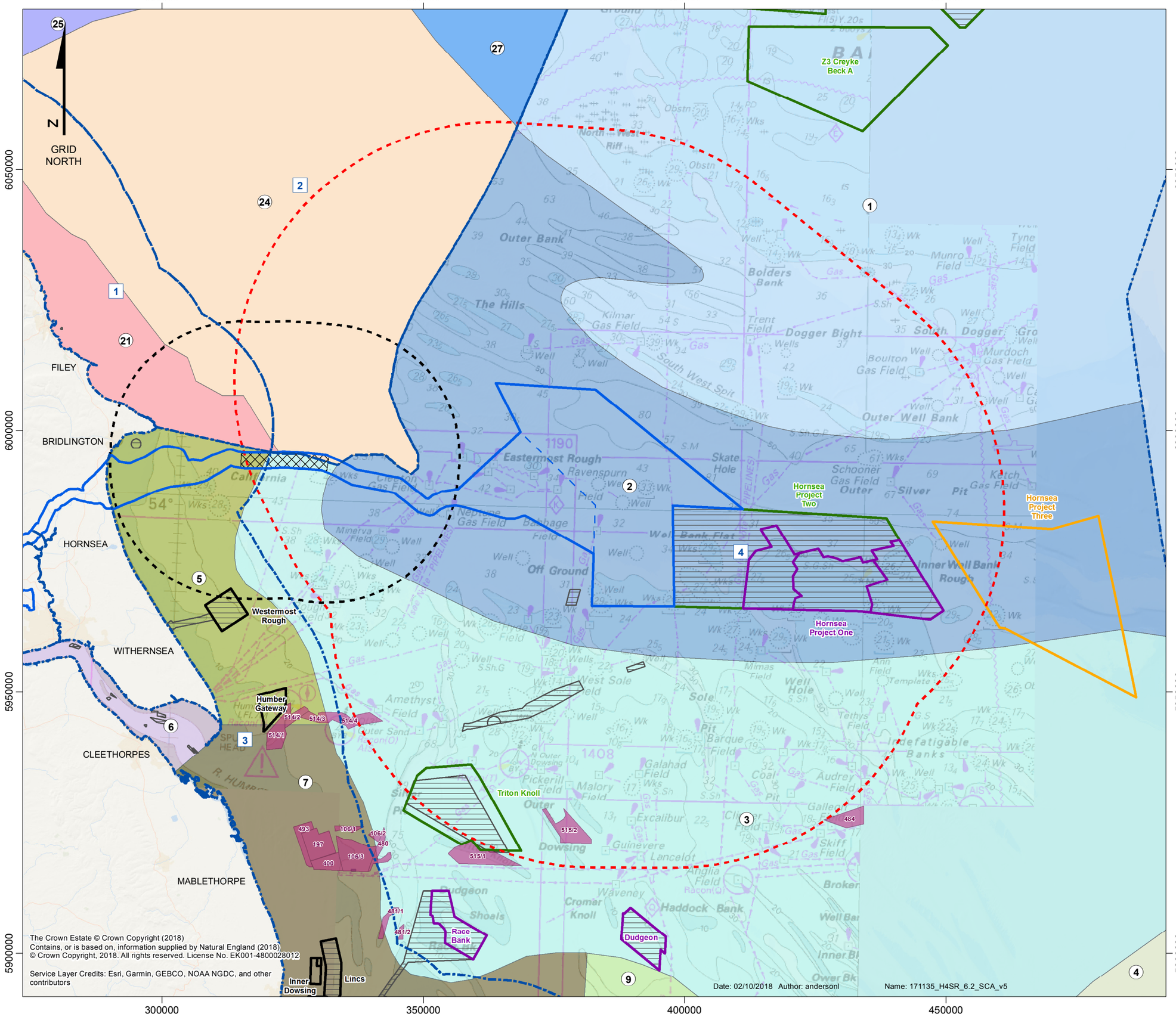
6.11.3.3 The study areas for the SVR assessment are located within four Marine Plan Areas (MPA) - East Inshore (MPA 3), East Offshore (MPA 4), North East Inshore (MPA 1) and North East Offshore (MPA 2) as illustrated on **Figure 6-53**. A seascape character area assessment covering MPAs 3 and 4 was published by the MMO in July 2012 (MMO, 2012). The purpose of the MMO assessment was to provide a strategic scale seascape character assessment to inform the marine planning process. It is this document that has been used to inform the key characteristics included in **Table 6-41**. The MMO seascape assessment is based upon an earlier pilot study seascape assessment commissioned by Natural England (Natural England, 2012).

6.11.3.4 No such characterisation has been published for MPAs 1 and 2, however the MMO has released a draft version (MMO, September 2018) in order to inform this scoping exercise. The overall characteristics of the defined Marine Character Areas (MCA) have been included within **Table 6-41**.

6.11.3.5 The MMO and the Natural England seascape character assessments divide the MPAs into smaller NSCAs as shown on **Figure 6-53**.

6.11.3.6 The baseline character of each of the NSCAs that may be altered physically or through visibility of Hornsea Four is set out in **Table 6-41**.

Hornsea Four
Present Day
Seascape Character Areas
Figure 6.53


300000
350000
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5950000
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N
GRID NORTH
FILEY
BRIDLINGTON
HORNSEA
WITHERNSEA
CLEETHORPES
MABLETHORPE
Outer Bank
The Hills
Bolders Bank
Dogger Bight
South West Spit
Outer Well Bank
Eastern Rough
Ravenspurn
Skate Hole
Schooner Gas Field
Outer Silver Pit
Ketch Gas Field
Off Ground
Well Bank Flat
Inner Well Bank Rough
Triton Knoll
Race Bank
Dudgeon
Hornsea Project One
Hornsea Project Two
Hornsea Project Three
Z3 Creyke Beck A
Westermost Rough
Humber Gateway
Inner Dowsing
Lincs
Dowsing
Haddock Bank
Cromer Knoll
Broken
Indefatigable Banks
Well Hole
Sole Pit
West Sole
Amethyst Field
Trent Field
Kilmar Gas Field
Boulton Gas Field
Murdoch Gas Field
Munro Field
Tyne Field
Nephrite Gas Field
Babbage Field
Minerva Field
Audrey Field
Galahad Field
Anglia Field
Skiff Field
Mimas Field
Tethys Field
Ann Field
Templeton Field
Pickerill Field
Malory Field
Excalibur
Guinevere
Lancelot
Waveney
Barque Field
Coal Pit
Clipper
Gallery
Racon(O)
Outer Dowsing
Outer Sand
Humber Flats
Spurn Head
R. Humber
California
Cleeton Gas Field
Hewett
Leman
Indefatigable
Tyne
Murdoch
Munro
Boulton
Trent
Kilmar
Nephrite
Babbage
Minerva
Amethyst
Audrey
Galahad
Pickerill
Malory
Excalibur
Guinevere
Lancelot
Anglia
Skiff
Mimas
Tethys
Ann
Templeton
Barque

Table 6-41 - Baseline character of NSCAs within the SVR assessment study areas

NSCA	Baseline Characteristics	Change in Character
Dogger Deep Water Channel	• "West-to-east deep channel which cuts across the south of Dogger Bank, known as the Outer Silver Pit; • Broad channel at its widest part is 125 to 175 km (75 to 105 miles) with waters deepening to between 60 and 70 metres in places; • Expansive seascape with small concentrations of gas platforms; • Significant fisheries area because of important fish spawning and nursery habitats; • Once a lake with tributaries of melt-water supplied from glaciers to north of Dogger Bank; • Designated as a military practice area; • Major North Sea navigation route; • Concentration of gas platforms; and • Important archaeological features present."	Hornsea Project One, Hornsea Project Two and Hornsea Project Three are located largely within this NSCA and will alter its character substantially during their construction and operation if they proceed.
Dogger Bank	• 'Extensive areas of relatively shallow waters; • Visually unified and expansive open water character; • Widespread sand bank habitat; • Important for fish spawning habitats and fish nursery areas; • Expansive seascape with few surface features; • Important archaeological potential of "Dogger land"; • Large area designated for Round 3 wind farms.'	Hornsea Project One, Hornsea Project Two and Hornsea Project Three are located close to the southern boundary of this NSCA and will alter the visual context of this NSCA through their visibility to the south during their construction and operation if they proceed.
East Midlands Offshore Gas Fields	• 'Concentrations of offshore gas extraction and aggregate extraction activities. • Extensive shallow offshore waters generally below 30 metres. • Represents some of the UK's most extensive stores of shallow subtidal sediments. • Series of submerged long straight sand banks and tidal sand ridges which pose navigational difficulties. • Widespread sand bank habitats that support large fish spawning and fish nursery grounds. • Commercial offshore activities such as fishing, dredging and dumping have a localised influence on benthic and pelagic environments. • Significant fisheries areas. • Important archaeological features present.'	Hornsea Project Three is located partially within this NSCA and will alter its character during its construction and operation if it proceeds due to physical alterations and views as part of the wider context. Hornsea Project One and Hornsea Project Two are located close to the northern boundary of this NSCA and will alter the visual context of this NSCA through their visibility to the north during their construction and operation if they proceed.
Holderness Coastal Waters	• 'Expansive, sweeping coastline undergoing dynamic natural coastal processes of erosion. • Extensive soft glacial till cliffs. • Heritage Coasts of Flamborough Head and Spurn Head to the northern and southern extents.	The Westermost Rough and Humber Gateway offshore wind farms are located within the southern part of this NSCA and have altered its character

NSCA	Baseline Characteristics	Change in Character
	• Open, exposed character by merit of low lying coastal topography and an absence of vegetation. • Large and featureless seaward horizon. • Flat topography results in the views of the seascape from land being generally restricted to coastal towns and immediate cliff edges. • Heavily potted coastal waters with strong fishing heritage. • Generally shallow waters which preclude commercial shipping. • Submerged gas pipelines and Easington Gas refinery. • Military practice area.' • Extensive WW1 and WW2 coastal defences, subject to coastal erosion. • Variety of roosting and feeding seabirds dispersing from nesting areas.	(since the 2012 study was undertaken) through physical and visual changes to it through the introduction of large scale, moving structures.
North Yorkshire Coastal Waters	'This MCA comprises shelving coastal waters off the North Yorkshire coast. South of Scarborough the coast is relatively low lying, with the Yorkshire Wolds dropping down to Flamborough Head and Filey Point. Filey Bay is a broad crescent shaped sandy bay south of Filey Point. Further north, bays are small, and lie between cliffs and rocky beaches where the North York Moors National Park meets the coast, with rugged coastal upland plunging to the sea in the form of sheer vertical cliffs and rocky bays. Settlement in the form of small ports and harbours occurs in the sheltered bays, including the historic fishing villages that cling to the cliffs at Robin Hood's Bay and Runswick Bay. There are a number of small harbours, with Scarborough being the largest. Offshore, there are rocks and submerged obstacles including wrecks. The wrecks illustrate that this was a treacherous coast, particularly around Flamborough Head and Filey Point, and alludes to the area's rich maritime heritage and significant involvement in both World Wars. This area is linked to Dogger Bank, which is known to have been exposed during Palaeolithic times, when the UK was connected to Europe by dry land. Doggerland, of which this MCA would have been part, was inundated after the last Ice Age. Dark skies and high levels of tranquillity characterise the undeveloped stretches of the coastline and neighbouring coastal waters.'	No substantial change anticipated within the study areas.
Breagh Oil and Gas Field	'A transitional area from the coastal waters off North Yorkshire towards the distant offshore area of Dogger Bank. Sandy substrate provides rich benthic and pelagic environments that benefit from the Flamborough Front; an upwelling of nutrients due to the mixing of waters from north and south, offshore of Flamborough Head. These support rich fishing grounds and important spawning grounds for several species including cod. Busy shipping lanes running out of Teesport and Port of Tyne cross through this MCA. The area is associated with Palaeolithic history of exposed land, known as Doggerland, which was inundated after the last ice age. This area played an important role in both World War I and World War II with East Coast War Channels allowing the transportation of coal and goods between the North East and the South and witnessed several naval engagements between the Royal Navy and German U-boats.'	No substantial change anticipated within the study areas.

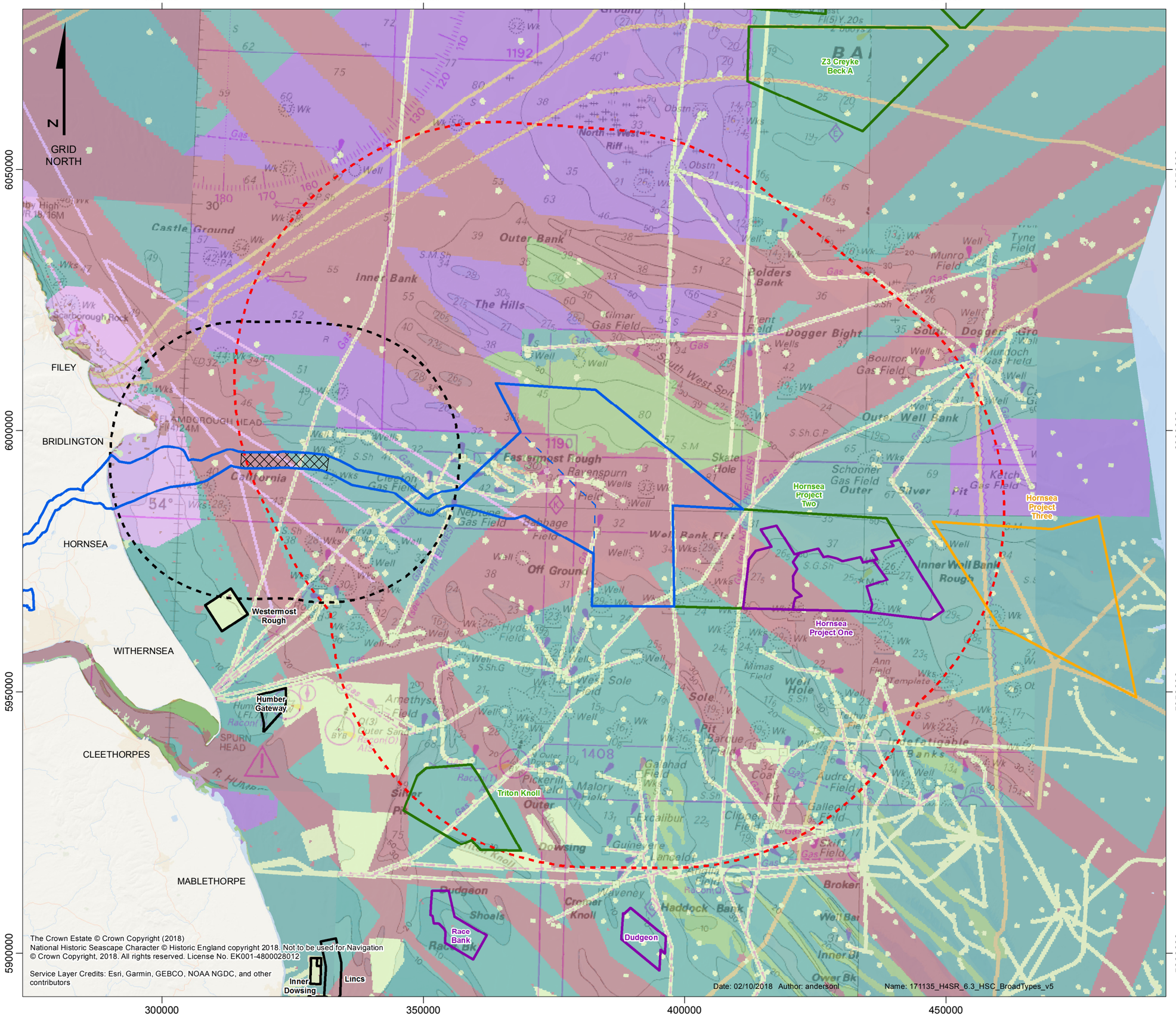
Seascape Resource - Historic Seascape Character Areas (HSCA)

6.11.3.7 The study areas for the assessment of the effects on HSC are the Hornsea Four array area and the offshore ECC.

6.11.3.8 In 2017 LUC published a report and GIS database commissioned by English Heritage (now Historic England) to consolidate all of the English HSCs prepared between 2009 and 2015. Reference has been made to the published information associated with this study and in particular the National Perspective Character Descriptions contained therein.

6.11.3.9 The HSCs divide the study area into a number of conflated Broad Historic Character Types (BHCT). The Hornsea Four array area is located within an area identified as having the following BHCTs: Navigation, Fishing, Industry, Cultural Topography and Military. The Hornsea Four offshore booster substation search area is located within an area which is identified as having the following BHCTs: Fishing, Industry, Recreation and Navigation (**Figure 6-54**)

Hornsea Four
Historic Seascape Character - Broad Historic Character Types
Figure 6.54



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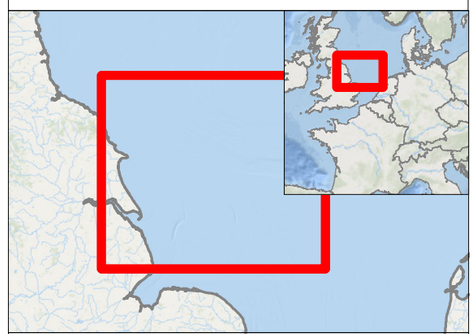
Date: 02/10/2018 Author: andersonl Name: 171135_H4SR_6.3_HSC_BroadTypes_v5

Hornsea Four
- Scoping Boundary
- Array Area
- HVAC Search Area

Study Area
- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Offshore Wind Farm Status:
- Active/In Operation
- Under Construction
- Consented
- Pre-planning Application

Broad Historic Character Type:
- Coastal infrastructure
- Communications
- Cultural topography
- Enclosed land
- Fishing
- Industry
- Military
- Navigation
- Ports and docks
- Recreation
- Settlement
- Unimproved land
- Woodland



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Historic Seascape Character - Broad Historic Character Types
Document no: H4SR_SV03
Created by: LA
Checked by: LT
Approved by: LK

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Broad Historic Character Types

6.11.3.10 The northern part of the Hornsea Four array area lies within an area defined as being within the Cultural Topography Coastal and Conflated Broad Type. LUC (2017) describes this Broad Type as: 'Character Types whose form appears largely the product of natural processes, but which are also made cultural and perceived culturally by people to varying extents. Many of these areas are often described as 'semi-natural environments' but it is their cultural dimension and perception that are the prime concerns of HSC.'

6.11.3.11 In this instance the characterisation relates to 'unspecified' areas reflecting a 'limitation of the HSC assessment of the areas it is applied to'. This area is associated with the Paleochannel Sub-Type of the Sub-Sea Floor level and is therefore considered to be of the Paleolandscape Character Type, which 'includes surviving areas of ancient topographic features from former exposed land which have strong potential for associated paleoenvironmental deposits and/or old land surfaces.'

6.11.3.12 Much of the rest of the Hornsea Four array area and parts of the offshore ECC are categorised as being of Navigation Broad Type. LUC (2017) describes this as identifying 'areas characterised by human activity directly relating to the passage of shipping traffic, such as navigation routes, anchorages and ferry crossings.'

6.11.3.13 A small peripheral area to the south and east of the array area and much of the offshore ECC are within the Fishing Broad Type. This is described as (LUC, 2017) referring to 'areas of the sea, estuaries and rivers whose character is dominated by activities concerned with the capture or gathering of wild fish and unfarmed shellfish stocks by various methods such as trawling, netting, trapping, potting, dredging and collection by hand.'

6.11.3.14 A small extent of the Hornsea Four array area in the north lies within the Military Broad Type which is an area of military activity ancillary to the locations of defensive or offensive activity in themselves, including training areas.

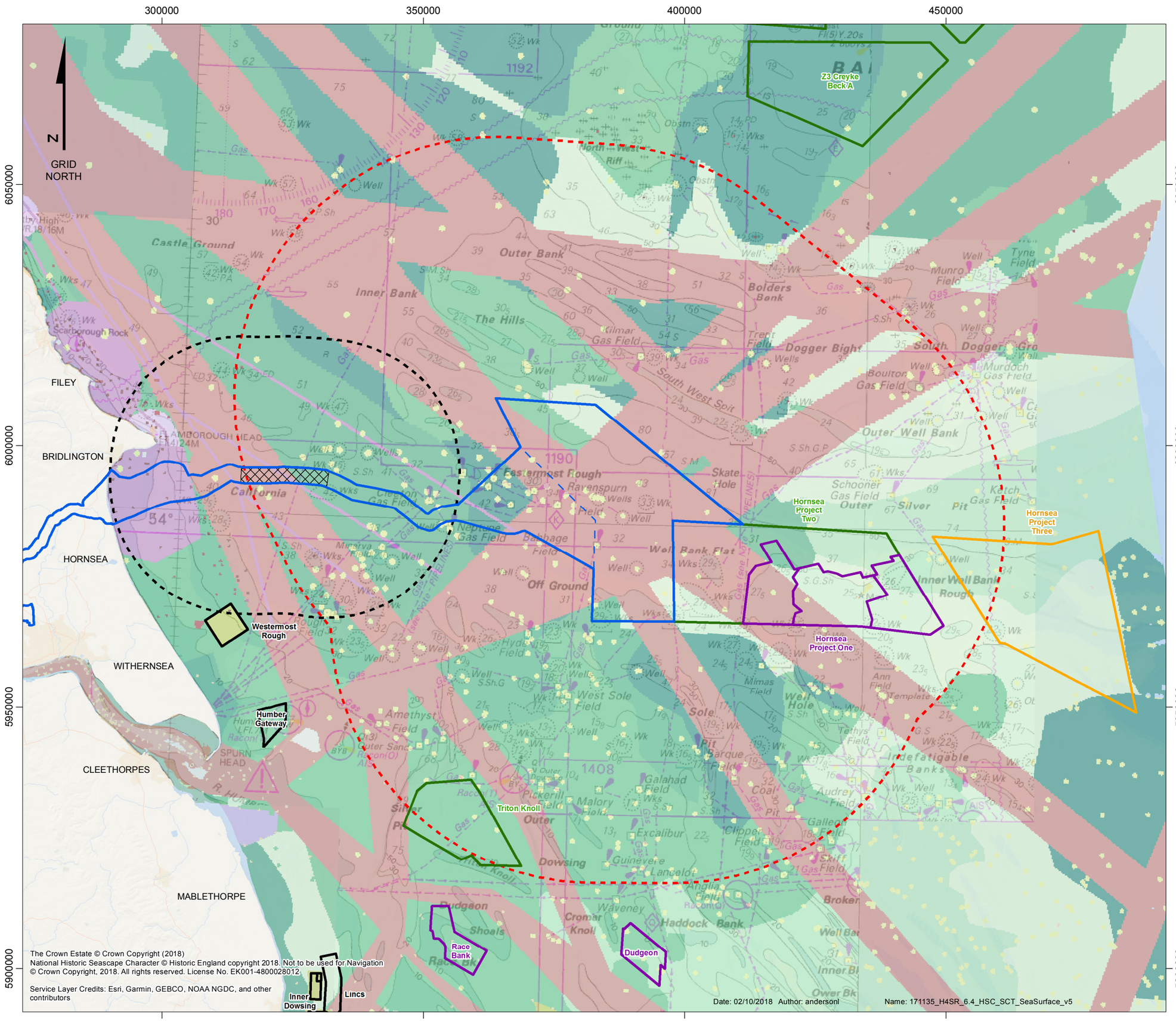
6.11.3.15 Crossing the Hornsea Four array area and within small isolated patches of the sea are areas of the Energy Industry Broad Type. This includes areas whose dominant character is concerned with the extraction, processing and/or storage of hydrocarbons; installations relating to all forms of renewable energy generation, by wind, wave or tide, and power stations of all fuels, together with their associated transmission facilities and directly associated transport facilities.

6.11.3.16 The offshore ECC is crossed by several linear routes of Recreational character whilst near to the shore there is a larger area of this BHCT. This area is defined by LUC as 'areas whose dominant character arises from activities and management whose primary purpose relates to leisure, pleasure, or inspiration. This broad definition includes areas devoted to a considerable diversity of coastal and marine specific tourist and leisure activities whose commercial income forms a very important sector of the coastal economy.'

6.11.3.17 These BHCTs are subdivided into Sub Character Types that are mapped for each level of the sea as follows and as shown on **Figure 6-55** - **Figure 6-58**:

- Sea Surface;
- Water Column;
- Sea Floor; and
- Sub-sea Floor.

Hornsea Four
Historic Seascape Character Types - Sub Character Types, Sea Surface
Figure 6.55



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Date: 02/10/2018 Author: andersonl

Name: 171135_H4SR_6.4_HSC_SCT_SeaSurface_v5

Hornsea Four
- Scoping Boundary
- Array Area
- HVAC Search Area

Study Area
- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Offshore Wind Farm Status:
- Active/In Operation
- Under Construction
- Consented
- Pre-planning Application

Sea Surface Sub-Type:

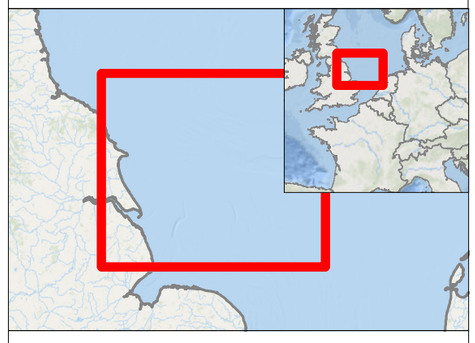
Fishing
- Bottom trawling
- Drift netting
- Fish trapping
- Fishing ground
- Fixed netting
- Longlining
- Pelagic trawling
- Potting
- Seine netting

Industry
- Hydrocarbon installation
- Renewable energy installation (wind)

Military
- Military practice area
- WW1 fortification

Navigation
- Anchorage
- Buoyage
- Hazardous water
- Navigation channel (active)
- Navigation route
- Safety area
- Submerged rocks
- Water turbulence
- Wreck hazard

Recreation
- Leisure fishing
- Leisure sailing
- Recreational dive area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Historic Seascape Character Types - Sub Character Types, Sea Surface
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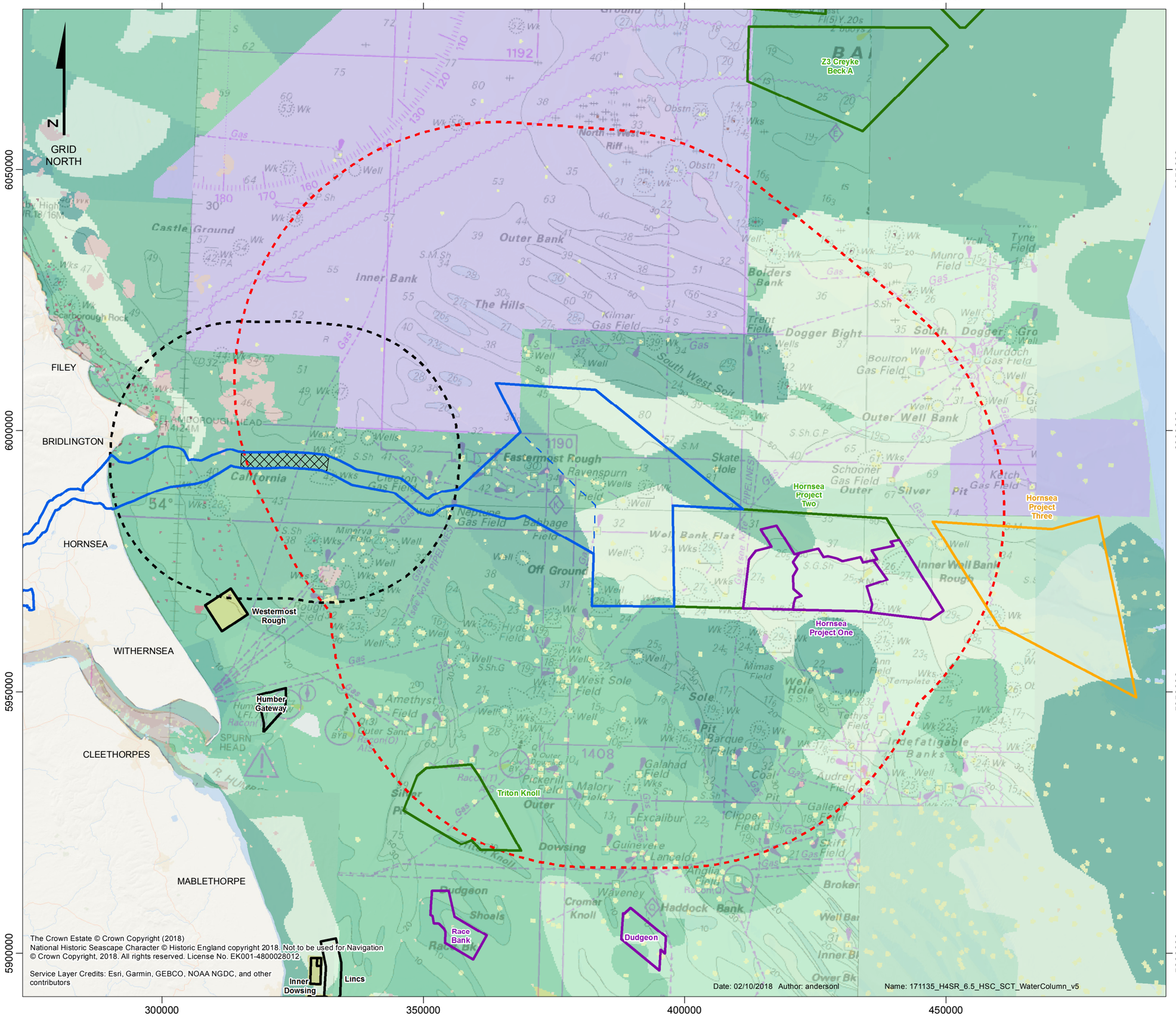
Hornsea Four
Historic Seascape Character Types - Sub Character Types, Water Column
Figure 6.56



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Name: 171135_H4SR_6.5_HSC_SCT_WaterColumn_v5

Hornsea Four
- Scoping Boundary
- Array Area
- HVAC Search Area

Study Area
- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Offshore Wind Farm Status:
- Active/In Operation
- Under Construction
- Consented
- Pre-planning Application

Water Column Sub-Type:

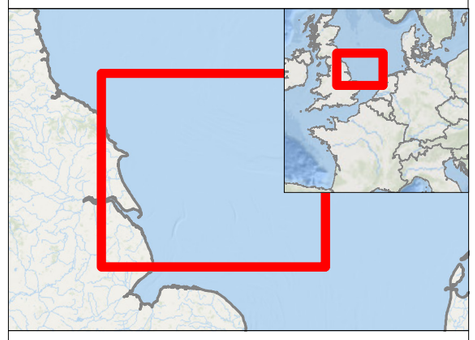
Fishing
- Bottom trawling
- Drift netting
- Fish trapping
- Fishing ground
- Fixed netting
- Longlining
- Pelagic trawling
- Potting
- Seine netting
- Shellfish dredging

Industry
- Hydrocarbon installation
- Renewable energy installation (wind)

Military
- Military practice area
- WW1 fortification

Navigation
- Anchorage
- Buoyage
- Hazardous water
- Navigation channel (active)
- Navigation route
- Submerged rocks
- Water turbulence
- Wreck hazard

Recreation
- Recreational dive area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Historic Seascape Character Types - Sub Character Types, Water Column
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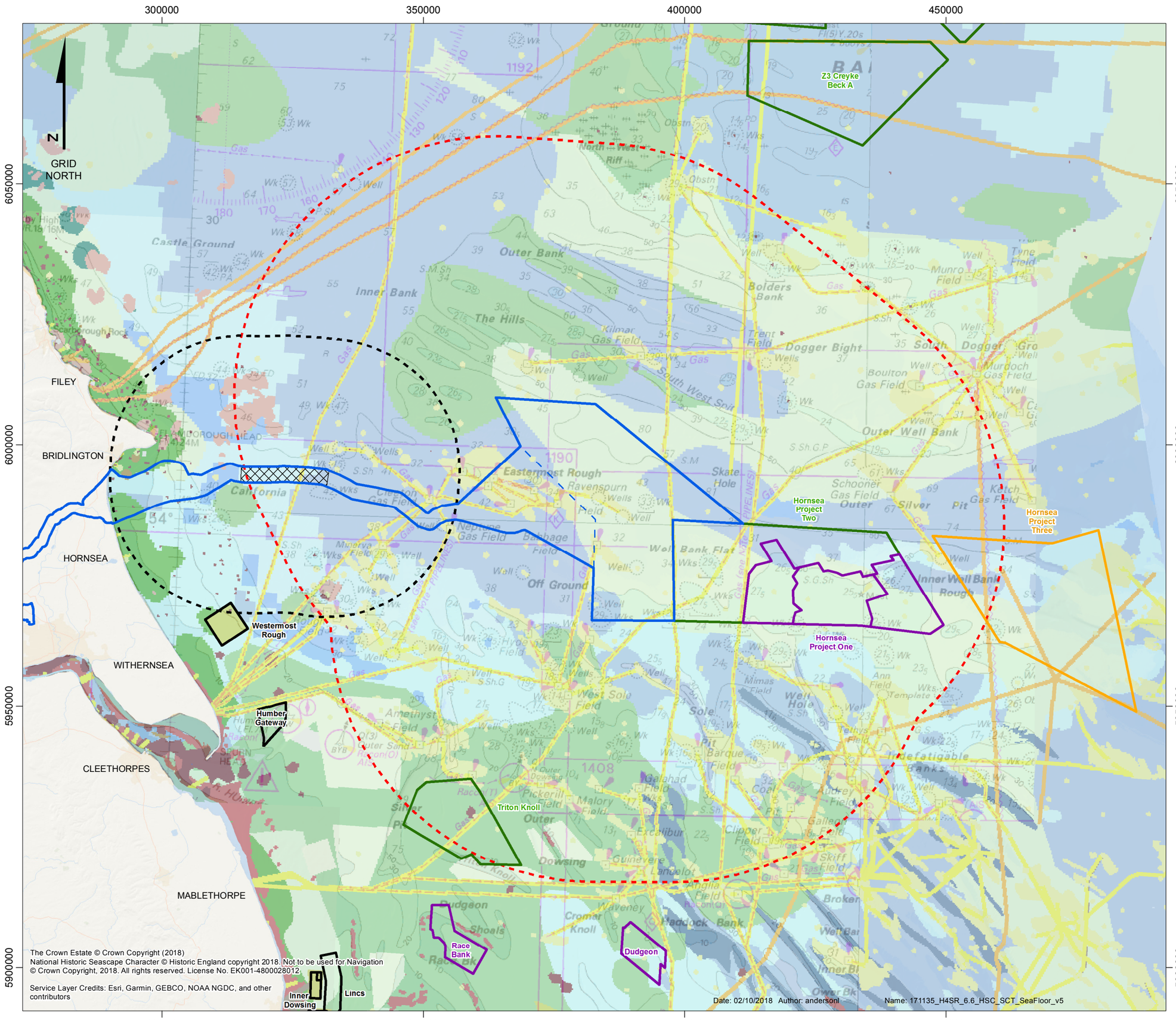
Hornsea Four

Historic Seascape Character Types - Sub Character Types, Sea Floor

Figure 6.57



Hornsea Four
- Scoping Boundary
- Array Area
- HVAC Search Area

Study Area
- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Offshore Wind Farm Status:
- Active/In Operation
- Under Construction
- Consented
- Pre-planning Application

Sea Floor Sub-Types:

Communications
- Submarine telecommunications cable

Cultural Topography
- Coarse sediment plains
- Exposed bedrock
- Fine sediment plains
- Mixed sediment plains
- Mud plains
- Sand banks with sand waves

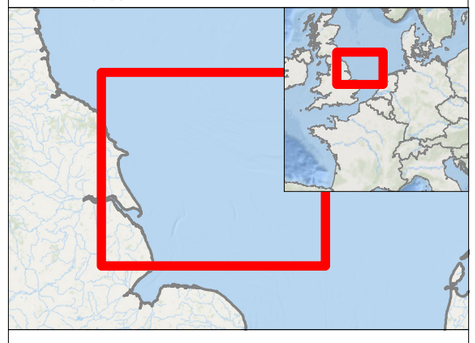
Fishing
- Bottom trawling
- Fish trapping
- Fishing ground
- Potting
- Shellfish dredging

Industry
- Aggregate dredging
- Hydrocarbon field (gas)
- Hydrocarbon installation
- Hydrocarbon pipeline
- Renewable energy installation (wind)
- Spoil and waste dumping
- Submarine power cable

Military
- WW1 fortification

Navigation
- Anchorage
- Maritime debris
- Safety area
- Shoals and flats
- Submerged rocks
- Wreck hazard

Recreation
- Recreational dive area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

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Name: 171135_H4SR_6.6_HSC_SCT_SeaFloor_v5

Historic Seascape Character Types - Sub Character Types, Sea Floor
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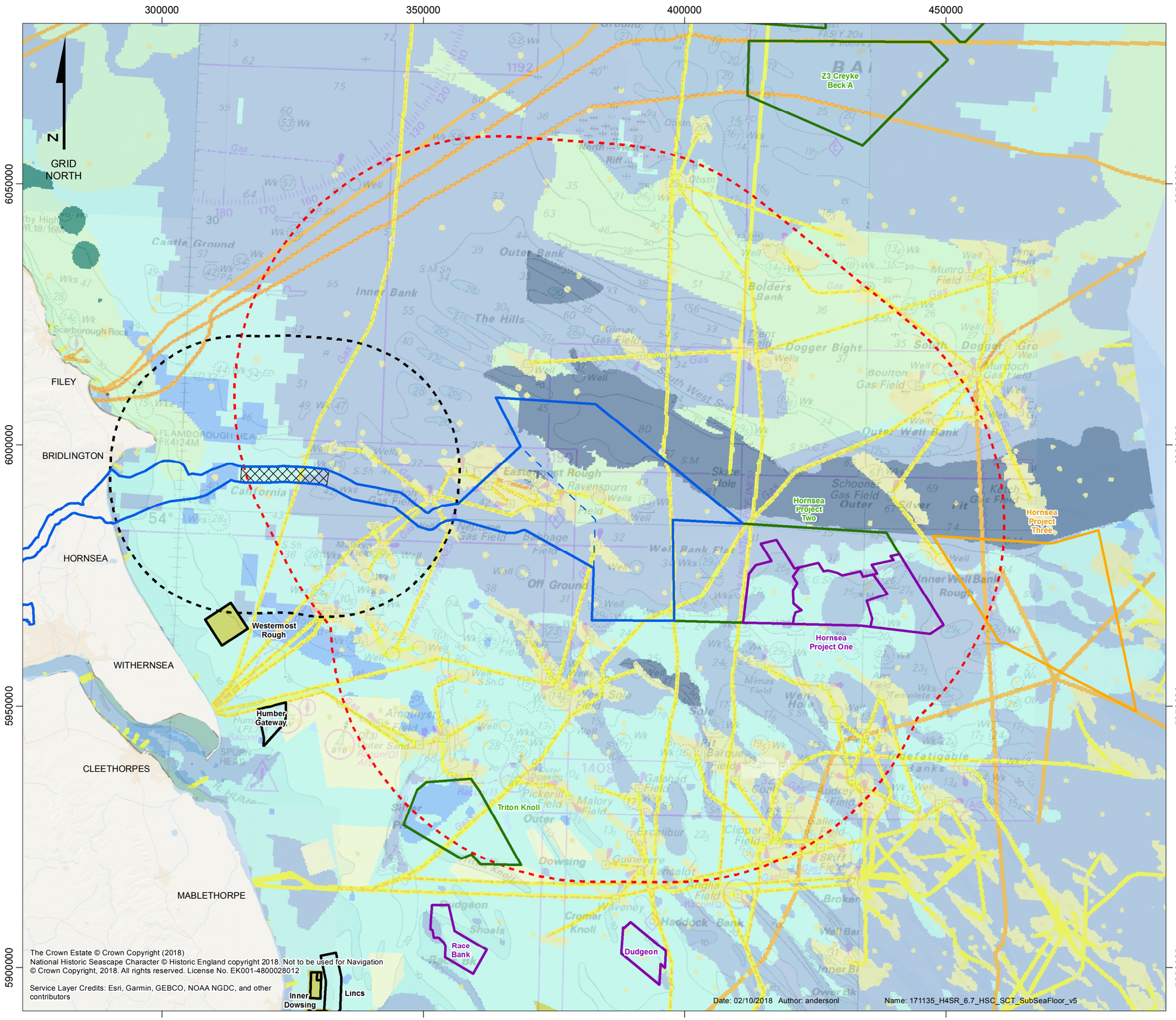
Hornsea Four
Historic Seascape Character Types - Sub Character Types, Sub-Sea Floor
Figure 6.58



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Name: 171135_H4SR_6.7_HSC_SCT_SubSeaFloor_v5

Hornsea Four
- Scoping Boundary
- Array Area
- HVAC Search Area

Study Area
- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Offshore Wind Farm Status:
- Active/In Operation
- Under Construction
- Consented
- Pre-planning Application

Sub-Sea Floor Sub-Type:

Communications
- Submarine telecommunications cable

Cultural Topography
- Coarse sediment plains
- Exposed bedrock
- Fine sediment plains
- Mixed sediment plains
- Mud plains
- Palaeochannel

Fishing
- Bottom trawling
- Shellfish dredging

Industry
- Aggregate dredging
- Hydrocarbon field (gas)
- Hydrocarbon installation
- Hydrocarbon pipeline
- Renewable energy installation (wind)

Military
- WW1 fortification

Navigation
- Wreck hazard

Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Historic Seascape Character Types - Sub Character Types, Sub-Sea Floor
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Landscape / Seascape Planning Designations and Defined Areas

6.11.3.18 Figure 6-59 illustrates the designations and defined areas located within the SVR study areas. There are no National Parks or Areas of Outstanding Natural Beauty within the study areas. There is an area defined as Heritage Coast around Flamborough Head. Heritage Coasts were established to conserve the best stretches of undeveloped coast in England. A Heritage Coast is defined by agreement between the relevant maritime local authorities and Natural England.

6.11.3.19 Heritage Coasts are protected through development control with the planning system. Paragraph 114 of the National Planning Policy Framework (March 2012) states that local authorities should: 'maintain the character of the undeveloped coast, protecting and enhancing its distinctive landscapes, particularly in areas defined as heritage coast, and improve public access to and enjoyment of the coast.'

Visual Resource

6.11.3.20 Figure 6-60 illustrates the visual receptors within the study areas. Users of the SVR study areas can be broadly defined as people that are undertaking recreational travel and those that are working. People undertaking recreational travel include those on yachts and other vessels who are doing so partly with the intention of enjoyment of their surroundings. The pattern of the Royal Yachting Association (RYA) cruising routes indicates that most journeys are close to the shore. The character of the views from these locations will be defined both by the landscape of the coast and the open sea.

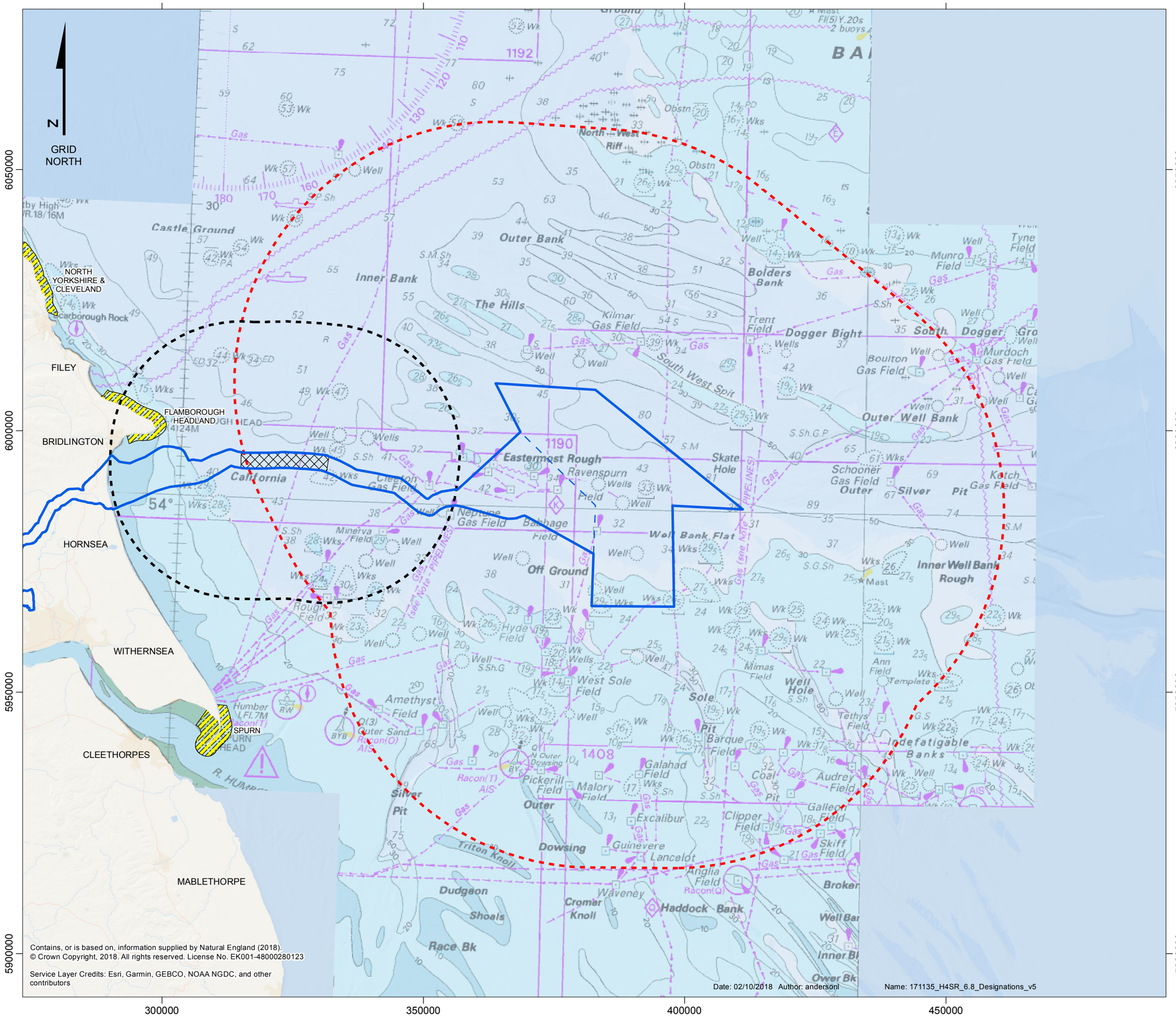
6.11.3.21 Other recreational travellers may be on a day cruise or travelling on a ferry as part of a holiday where they will pass from the shore to the open sea. The majority of the views obtained by these people are of the open sea with occasional glimpses of gas platforms or associated infrastructure and other vessels. In the future they may also gain close range views of the under construction and consented wind farms.

6.11.3.22 Ferries carry many people that are working. Air combat training also takes place over the study areas. Fishing of many types occurs extensively. There are also numerous manned platforms within the study areas and a number of aggregate areas and open disposal areas, in the south west of the Hornsea Four array area study area.

6.11.3.23 The types of visual receptor known to be present within the study areas can therefore be described as follows:

- Sailors following the cruising routes identified by the RYA, which are largely located close to the coast;
- Passengers and workers on board commercial ferries or cruise liners;
- People at their place of work on passing cargo, tanker or other commercial vessels;
- People at their place of work on manned static gas platforms or travelling to the platforms;
- People at their place of work on commercial fishing vessels;
- People at their place of work on aggregate vessels; and
- Military personnel using identified Military Practice Areas.

Hornsea Four
Landscape / Seascape Planning Designations and Defined Areas
Figure 6.59



Hornsea Four

Scoping Boundary

Array Area

HVAC Search Area

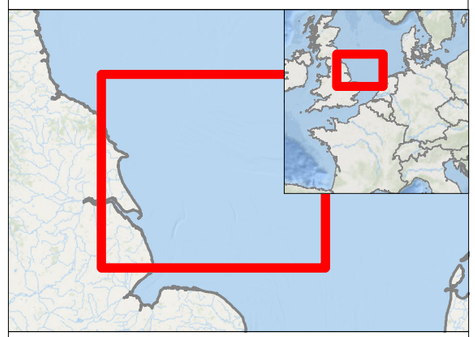
Study Area

50km Array Seascape and Visual Resource Study Area

25km HVAC Booster Station Seascape and Visual Resouce Study Area

Landscape / Seascape Designation

Heritage Coast



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Landscape / Seascape Planning Designations and Defined Areas
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Hornsea Four
Offshore Visual Receptors and Viewpoint Location
Figure 6.60

300000 350000 400000 450000

6050000 6000000 5950000 5900000

N
GRID NORTH

Z3 Creyke Beck A
Hornsea Project Two
Hornsea Project Three
Hornsea Project One
Triton Knoll
Race Bank
Dudgeon
Westermost Rough
Humber Gateway
Inner Dowsing
Lincs

1 2 3 4 5

Castle Ground
Outer Bank
Inner Bank
The Hills
North West Riff
Bolders Bank
Dogger Bight
South West Spit
Outer Well Bank
Eastermost Rough
Skate Hole
Off Ground
Inner Well Bank
Bank Flat
Haddock Bank
Dowsing
Cromer Knoll
Shoals
Pudgeon
Broker
Indefatigable Banks
Silver Pit
Outer Silver Pit
Ower Bk

FILEY
BRIDLINGTON
HORNSEA
WITHERNSEA
CLEETHORPES
MABLETHORPE

Trent Field
Kilmar Gas Field
Boulton Gas Field
Schooner Gas Field
Munro Field
Tyne Field
Murdoch Gas Field
Ketch Gas Field
Clipper Field
Skiff Field
Galleon Field
Audrey Field
Coal Pit
Barque Field
Galahad Field
Pickerill Field
Malory Field
Excalibur
Guinevere
Lancelot
Anglia Field
Waveney
Amethyst Field
West Sole Field
Hyde Field
Minerva Field
Neptune Gas Field
Babbage Field
Cleeton Gas Field
Ravenspurn Field
Mimas Field
Ann Field
Tethys Field
Sole Pit
Inner Well Bank Rough

Hornsea Four
- Scoping Boundary
- Array Area
- HVAC Search Area

Study Area
- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Offshore Wind Farm Status:
- Active/In Operation
- Under Construction
- Consented
- Pre-planning Application

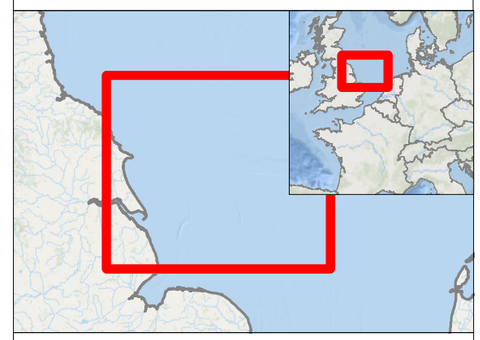
Existing Aggregate Area
- Active Aggregate and Option Area
- Open Disposal Site

Oil and Gas Platform
- Offshore Platform
- Offshore Platform (Manned)

RYA and Ferry Routes
- Newcastle - Amsterdam
- Approximation of Newcastle - Amsterdam Ferry Route (Deviation)
- Offshore routes
- RYA Clubs
- RYA Training Centres
- Marinas
- General boating areas

AIS Boating Intensity
- Low
- High

Viewpoint
- Wireframe Location



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Offshore Visual Receptors and Viewpoint Locations
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Name: 171135_H4SR_6.9_VisReceptors_v5

6.11.3.24 The main ferry routes through the study area are used by the Newcastle to Amsterdam 'Cruise Ferries which generally pass through the study area twice each day. The ferry route would be required to deviate slightly to avoid the Hornsea Four array area. The cruise ferry departs Newcastle daily at 17:00 and the return journey arrives back at Newcastle at 09:00 or 09:30. Based on the published departure times and a cruising speed of 21 knots it is possible to estimate the approximate times the ferries will pass through the study area.

6.11.3.25 Based on average cruising speeds and the scheduled 17:00 daily departure time of the cruise ferry from Newcastle, this suggests that the cruise ferry would pass through the 50 km study area around Hornsea Four during the hours of darkness for the majority of the year i.e. arriving at the northern edge of the study area at 20.15 and leaving the southern edge at 00.25.

6.11.3.26 On the scheduled journey leaving Amsterdam at 17:30, for the majority of the year, again, the cruise ferry will pass through the study area during the hours of darkness i.e. arriving at the southern edge of the study area at 22.50 and leaving the northern edge at 03.00.

6.11.3.27 The visual characteristics of the array area study area could be described as relatively homogenous due to the distance of the Hornsea Four array area to the coast. Views consist mainly of open seas with occasional views of offshore structures, such as platforms. There is regular passage of use by sea-going vessels for a variety of purposes, including recreational cruising, commercial ferry routes, commercial fishing activities, tankers and cargo vessels with such activity introducing movement and change within the views. Overhead combat training in aeroplanes furthers this characteristic of movement and change.

6.11.3.28 The western part of the study area for the offshore HVAC booster substations is more visually influenced by coastal views and a higher density of recreational vessels and smaller fishing boats.

6.11.4 Summary and Key Issues

6.11.4.1 The offshore area defined as Heritage Coast at Flamborough Head is partially within the study area for the offshore HVAC booster substations as shown on **Figure 6-59**.

6.11.4.2 The main Present-Day Seascape Character effects will occur in and around the Hornsea Four array area. This is located within the Dogger Deep Water Channel Seascape Character Area, which is described as a large-scale area of deep, open sea where there is a sense of isolation and little in the way of visual cues such as those that are experienced closer to the shore. This is however, also the Present-Day Seascape Character area that will be altered by Hornsea Project One and Hornsea Project Two.

6.11.4.3 The main changes to the HSC sub-types will occur as a result of the WTGs and the offshore substation and accommodation platforms within the Hornsea Four array area. The changes will occur through all levels of the HSC sub-types from Sub-sea floor up to sea surface.

6.11.4.4 The offshore HVAC booster substations would introduce further industrialisation to localised areas through all levels of the HSC sub-types which are influenced by navigational and fishing vessels on the Sea Surface. In addition, hydrocarbon installations occur as point features in the Sea Surface and Water Column and linear intrusions on the

Sea Surface and Sub-sea Surface levels. Closer to the shore within the offshore ECC the industrial characterisation is reduced and the Sea Surface (within approximately 15 km of the shore) is characterised by leisure sailing activity which may be considered to be of higher sensitivity to further industrialisation.

6.11.4.5 It is assessed from a review of the baseline visual receptors that the people in vessels for the purpose of recreation are likely to be the most sensitive to the proposed changes in their views which would occur as a result of Hornsea Four.

6.11.4.6 Of particular importance in relation to the context of Hornsea Four will be the increased influence of nearby offshore wind farm development being constructed and becoming operational within a part of the context on the seaward side of the Hornsea Four array area. In addition, the consented Triton Knoll Offshore Wind Farm would also be influential when it is constructed in the south-west of the study area.

6.11.5 Project Basis for Scoping Assessment

6.11.5.1 In order to consider the likelihood for significant effects to arise on the seascape and visual receptors described above a preliminary worst case scenario WTG layout has been developed to inform this SVR assessment.

6.11.5.2 At this early stage in the application process a WTG layout has been prepared that evenly distributes 180 turbines of up to 370 m to tip across the Hornsea Four array area so that the maximum horizontal and vertical extents of Hornsea Four can be appreciated in combination with the maximum number of WTGs possible. **Figure 6-61** illustrates this layout.

Hornsea Four
Turbine Blade Tip
Zone of Theoretical Visibility
Figure 6.61

300000 350000 400000 450000

6050000 6000000 5950000 5900000

N
GRID NORTH

FILEY
BRIDLINGTON
HORNSEA
WITHERNSEA
CLEETHORPES
MABLETHORPE

Hornsea Four

- Scoping Boundary
- Array Area
- HVAC Search Area
- Preliminary Worst Case Scenario Turbine Layout for Seascape and Visual Resource Assessment

Study Area

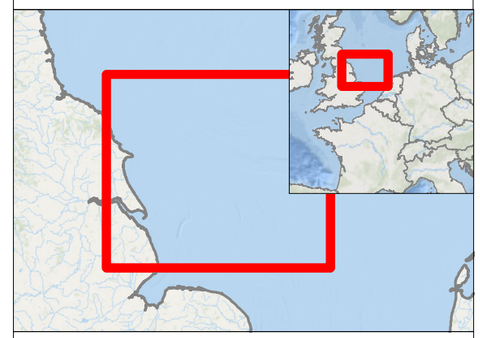
- 50km Array Seascape and Visual Resource Study Area
- 25km HVAC Booster Station Seascape and Visual Resouce Study Area

Blade Tip Zone of Theoretical Visibility

No. of Turbines Visible

- 1 - 30
- 31 - 60
- 61 - 90
- 91 - 120
- 121 - 150
- 151 -180

Blade Tip:	370m	Observer height:	2m
DTM:	OS T50	Surface features:	Excluded
DTM Resolution:	50m	Earth curvature:	Included



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:700000

0 5 10 20 30 40 Kilometres

0 2 4 8 12 Nautical Miles

Turbine Blade Tip
Zone of Theoretical Visibility
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Name: 171135_H4SR_6.10_ZTV_BT_v5

6.11.5.3 It is known that offshore substations will be located within the WTG array area. The maximum dimensions of these structures is 100m (excluding helideck or lightning protection) with a length and width of 180 m and 90 m respectively.

6.11.5.4 In addition, the worst-case scenario considered in this preliminary SVR assessment includes for up to three above sea surface HVAC booster substations of a similar scale to the offshore substations and located along the offshore ECC within the offshore HVAC booster substation search area shown on **Figure 6-52**.

6.11.5.5 The cumulative context is also of importance to this SVR assessment. **Figure 6-52** illustrates the cumulative wind farms in their assumed layouts for the purposes of this Scoping Report.

6.11.5.6 It is assumed that aviation and other lighting will be a requirement for some of the WTGs within the array area.

6.11.6 Embedded Mitigation

6.11.6.1 Given the transitory and dynamic nature of the majority of the visual receptors, no additional measures are proposed specifically in relation to the location or arrangement of the wind turbines. Therefore, no mitigation measures are proposed in relation to seascape character.

6.11.7 Likely Significant Effects

6.11.7.1 **Table 6-42** sets out an assessment of effects on the SVR at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in **Annex A**) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.11.7.2 The assessment presented in **Table 6-42** is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in **section 6.5.5**,); the level of understanding of the baseline at this stage; the evidence base for offshore and intertidal ornithology effects; relevant policy; the assessment criteria provided in **Annex C**; the question-led approach set out in **section 1.7**; and the professional judgement of qualified ornithologists.

6.11.7.3 **Table 6-42** is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.11.7.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 6-42 - Likely Effects – Seascape and Visual Resources

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Construction phase: Offshore construction activities visible by day and night from offshore visual receptors.	None	Moderate to low	Low to medium	**No likely significant effects**	**Scoped Out**	None
Construction phase: Offshore construction activities alter present day seascape character through physical and visual changes to the present-day seascape character.	None	Moderate to low	Low	**No likely significant effects**	**Scoped Out**	None
Construction phase: Offshore construction activities alter historic seascape character through physical changes to it.	None	Moderate to low	Generally low. Medium for Sea Surface Leisure sailing and Sub-sea floor Paleochannel sub-types	**No likely significant effects**	**Scoped Out**[8]	None
Construction phase: Offshore construction activities cumulatively alter the visual resource and seascape character through changes (by day and night) to the seascape in the context of other offshore development.	None	Low	Generally low. Valued and sensitive receptors sited in areas close to shore are of medium sensitivity to cumulative effects.	**No likely significant effects**	**Scoped Out**	None

[8] The effect on the sub-sea floor Paleochannel sub-type is considered in section 6.7 (Marine Archaeology).

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Operation phase: Offshore HVAC booster substations and Array Area visible by day and night from offshore visual receptors.	None	Moderate to low	Low to medium	**No likely significant effects**	**Scoped Out**	None
Operation phase: Offshore HVAC booster substations and Array Area alter seascape character through changes to the present-day seascape character.	None	Moderate to low	Low	**No likely significant effects**	**Scoped Out**	None
Operation phase: Offshore HVAC booster substations and Array Area alter seascape character through changes to the characteristics of the historic seascape character.	None	Moderate to low	Generally low. Medium for Sea Surface Leisure sailing and Sub-sea floor Paleochannel sub-types	**No likely significant effects**	**Scoped Out**[9]	None
Operation phase: Offshore HVAC booster substations and Array Area cumulatively alter the visual resource and seascape character through changes to the seascape in the context of other offshore development.	None	Low	Generally low. Valued and sensitive receptors sited in areas close to shore are of medium sensitivity to cumulative effects.	**No likely significant effects**	**Scoped Out**	None
Decommmissioning phase: Offshore decommissioning activities visible from offshore visual receptors.	None	Moderate to low	Low to medium	**No likely significant effects**	**Scoped Out**	None None

[9] The effect on the sub-sea floor Paleochannel sub-type is considered in **section 6.7** (Marine Archaeology).

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Decommmissioning phase: Offshore decommissioning activities alter seascape character through changes to the present-day seascape character.	None	Moderate to low	Low	**No likely significant effects**	**Scoped Out**	None
Decommmissioning phase: Offshore decommissioning activities alter seascape character through changes to the characteristics of the historic seascape character.	None	Moderate to low	Generally low. Medium for Sea Surface Leisure sailing and Sub-sea floor Paleochannel sub-types	**No likely significant effects**	**Scoped Out**[10]	None
Decommmissioning phase: Offshore decommissioning activities cumulatively alter the visual resource and seascape character through changes to the seascape in the context of other offshore development.	None	Low	Generally low. Valued and sensitive receptors sited in areas close to shore are of medium sensitivity to cumulative effects.	**No likely significant effects**	**Scoped Out**	None

[10] The effect on the sub-sea floor Paleochannel sub-type is considered in **section 6.7** (Marine Archaeology).

6.11.8 Impacts Scoped Out of Assessment

6.11.8.1 Cumulative wireline visualisations have been prepared for five representative viewpoint locations. These show either a 90-degree field of view or a 180-degree field of view in order to illustrate the immediate offshore wind farm context. The locations are shown on Figure 6-60 and the wirelines included in Annex D.

6.11.8.2 Given the transitory nature of the majority of visual receptors within the study area, a series of representative viewpoints was selected to illustrate the potential effects of the Hornsea Four array area. The selected locations, listed below, represent different types of visual receptors, viewing heights, distances and orientations from the Hornsea Four array area:

- **Viewpoint 1: Newcastle - Amsterdam ferry route (NW).** Viewpoint height 26.5 m above LAT;
- **Viewpoint 2: RYA offshore route.** Located to the west of the Hornsea Four array area and close to the offshore ECC. Viewpoint height 4m above LAT;
- **Viewpoint 3: Cleeton Gas Platform** is situated to the west of the Hornsea Four array area and just north of the offshore ECC (viewpoint height nominal 34.5 m above LAT);
- **Viewpoint 4: Newcastle – Amsterdam ferry** route approximate diversion (SW). South-west of Hornsea Four array area. Viewpoint height 26.5 m above LAT; and
- **Viewpoint 5: Newcastle – Amsterdam ferry route approximate diversion (SE).** South-east of Hornsea Four array area. Viewpoint height 26.5 m above LAT.

6.11.8.3 A ZTV has been prepared (Figure 6-61) to illustrate the theoretical extent of WTG visibility based on the same preliminary layout. This illustrates that it will be possible to see the WTGs across the 50 km radius study SVR area. Not all of the turbines are shown to be visible near the edges of the study area in the north-west and south-east. In addition, only the upper parts of the WTGs will be visible from the edges of the study area due to the earth's curvature.

6.11.8.4 Effects of Hornsea Four array area, the offshore HVAC booster substations and the offshore cable route on the offshore visual resource during construction, operation and decommissioning are scoped out as a result of a combination of the following factors:

- The considerable distance from the area where the majority of movements of people on recreational boats (which are considered to be the most sensitive receptors) are shown to occur (Figure 6-60);
- The visual effect on any areas designated for their landscape or scenic quality (i.e. the seaward area of the Heritage Coast) is limited due to distance;
- The timing of the main ferry traffic through the study area, which is largely in the evening or at night;
- The transient nature of the majority of the visual receptors travelling through the study areas reduces their sensitivity and the duration of any effects;
- The lower levels of sensitivity that are attributed (in GLVIA3) to people undertaking work such as those on manned platforms, people working in aggregate vessels, ferry crew and people undertaking military practice activities;
- The limited above sea level activities involved in the cable route construction, decommissioning and operation will be of low magnitude in the context of the other vessel movements and platforms;
- The existing character of the offshore sea area which is influenced by platforms, large scale vessel movements and offshore wind farms;

- The large areas of easily accessible open sea that will remain and therefore offer alternative routes for enjoyment of views of the open sea by recreational boaters; and
- The large scale and simplicity of the offshore sea area, which are characteristics commonly associated with higher levels of capacity to accommodate large scale wind farm development.

6.11.8.5 Effects of Hornsea Four array area, offshore HVAC booster substations and offshore cable route construction, operation and decommissioning on the offshore present day and historic seascape character are scoped out as a result of a combination of the following factors:

- The seascape that will be affected by Hornsea Four is not designated or covered by a defined area that would lead to a heightened value or increased sensitivity;
- The limited duration and nature of the cable route construction and decommissioning which will be of low magnitude within a context that contains extensive large-scale vessel movement;
- The effects on the HSC sub-types are localised. The HSC subtypes are influenced by navigational and fishing vessels on the Sea Surface. In addition, hydrocarbon installations occur as point features in the Sea Surface and Water Column and linear intrusions on the Sea Surface and Sub-sea Surface levels;
- The area of the seascape that will be affected over a long duration is of large scale and simple, as well as having characteristics that have been modified by humans through the development of hydrocarbon installations and pipelines, thus reducing its sensitivity to large scale offshore wind farm development and offshore HVAC booster substations; and
- The form and nature of the proposed Hornsea Four offshore wind farm is such that large scale WTGS will be seen as tall, moving, widely spaced structures with large areas of sea running between them so that they will appear as WTGs set within an open sea rather than the WTGs being the only character influence.

6.11.8.6 Cumulative effects of Hornsea Four array area, offshore HVAC booster substations and offshore cable route construction operation and decommissioning on the offshore seascape and visual resource are scoped out as a result of a combination of the following factors, in addition to those noted above:

- Hornsea Four is the closest of the Hornsea Wind Farms to the coast with other large-scale offshore wind farms being at a greater distance from the shore, collectively positioned to extend away from majority of visual receptors so that the horizontal extent of the wind farm views is limited from where the majority of the most sensitive receptors are concentrated;
- The offshore HVAC booster substations and the offshore cable route will not be located close to those of other offshore wind farm developments;
- The Hornsea Four array area as well as the other Hornsea Wind Farms are all located within the wide, open sea which is defined as the Dogger Deep Water Channel NSCA. This is a very large area of expansive seas which are large in scale and simple with few visual receptors and is able to accommodate large scale wind farm development; and
- Other offshore wind farm development is located at some considerable distance from the Hornsea Four array area, on the edge of the Hornsea Four array area study area and within a different NSCA.

6.11.8.7 Night time effects on visual receptors are scoped out as in the hours of darkness sensitive visual receptors would not be moving through the open seas with the purpose of

appreciating the views or their surroundings or are undertaking their work and are therefore of lower sensitivity to changes in their views.

6.11.9 Proposed Approach to the PEIR and ES

6.11.9.1 It is proposed to scope out of all the potential impacts on SVR from any further consideration in the EIA process.

6.11.10 Scoping Questions for Consultees

6.11.10.1 Scoping questions for consultees in relation to SVR include

1. Do you agree that the offshore SRV effects can be scoped out as proposed in **Table 6-42** above?
2. Do you agree that the offshore SRV effects of the offshore HVAC booster substations be scoped out if they are proposed to be located below sea surface or 25 km from the shore and set back from the Hornsea Four array area?

6.12 Infrastructure and Other Users

6.12.1 Introduction

6.12.1.1 This section of the Scoping Report identifies the infrastructure and other marine user receptors of relevance to Hornsea Four (See list in **section 6.12.2**) and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components (i.e. seaward of MHWS) of Hornsea Four on infrastructure and other marine users.

6.12.1.2 Shipping and navigation receptors are addressed separately within **section 6.9**, aviation and radar receptors in **section 6.10**, commercial fisheries receptors in **section 6.8**, and recreational users in **section 6.10**.

6.12.2 Study Area

6.12.2.1 The infrastructure and other marine users study area includes all infrastructure and other marine user receptors within an area which has the potential to be affected by Hornsea Four. The area was attributed using knowledge of previous studies carried out for Hornsea Project One, Hornsea Project Two, and Hornsea Project Three. This includes the Hornsea Four array area and the offshore ECC, which comprises the offshore development footprint, and extends out to the areas described in **section 6.12.3**. The following infrastructure and other marine user receptors will be considered:

- other Offshore Wind Farms (OWFs);
- existing and proposed cables and pipelines;
- Carbon Capture and Storage (CCS) and natural gas storage;
- disposal sites;
- MOD Practice and Exercise Areas (PEXAs);
- aggregate extraction; and
- oil and gas operations.

6.12.3 Baseline Environment

Data Sources used for Scoping

6.12.3.1 An initial desk-based review of the literature and data sources was undertaken to support this Scoping Report. The data sources providing coverage of the Hornsea Four array area and offshore ECC are listed in **Table 6-43**.

Table 6-43 - Key Sources of Infrastructure and Other Users Data

Source	Summary	Coverage of Hornsea Four array area and ECC
The Crown Estate (TCE) Charts Offshore Wind Lease Agreement Areas	Other offshore wind farms	Full coverage of the Hornsea Four array area and ECC.
OceanWise Marine Themes Kingfisher Information Service – Cable Awareness (KIS-ORCA) UK Oil and Gas Data	Offshore cables and pipelines (including proposed cables such as Viking Link)	Full coverage of the Hornsea Four array area and ECC.
OceanWise Marine Themes TCE	Disposal sites	Full coverage of the Hornsea Four array area and ECC.

Source	Summary	Coverage of Hornsea Four array area and ECC
TCE Aggregate Licence Area Charts	Marine aggregate extraction	Full coverage of the Hornsea Four array area and ECC.
TCE	CCS	Full coverage of the Hornsea Four array area and ECC.
TCE	Natural gas storage	Full coverage of the Hornsea Four array area and ECC.
BEIS UK Oil and Gas Data	Oil and gas infrastructure	Full coverage of the Hornsea Four array area and ECC.
OceanWise Marine Themes	PEXAs	Full coverage of the Hornsea Four array area and ECC.

Overview of Baseline Environment

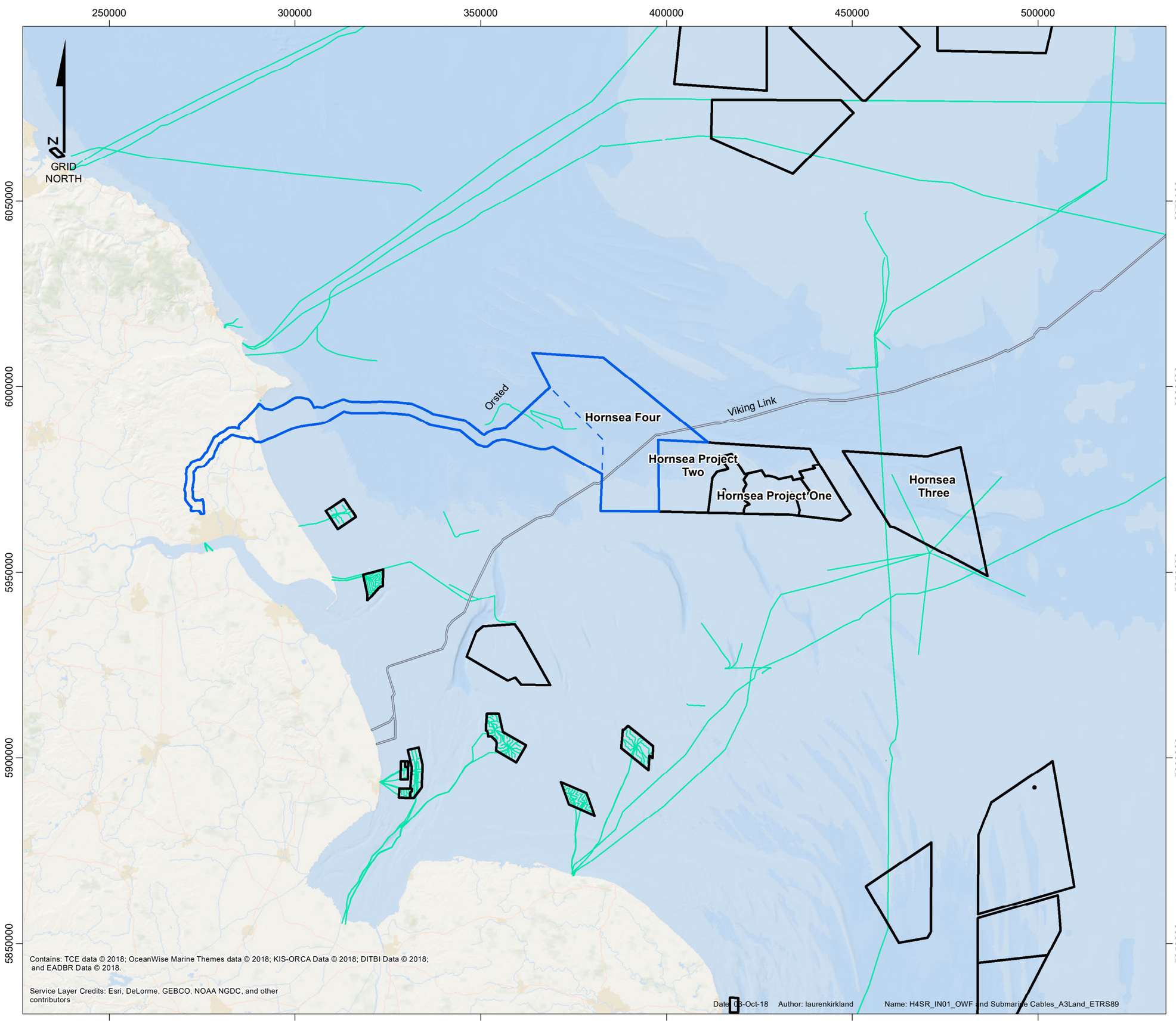
Other Offshore Wind Farms

6.12.3.2 The OWFs proposed, under construction or in operation in the Southern North Sea near Hornsea Four are shown in **Figure 6-62**

6.12.3.3 The nearest under construction wind farm is Hornsea Project One located 5.1 km from the Hornsea Four array area and 30.9 km from the offshore ECC. Construction of Hornsea Project One started in September 2017 and is scheduled to finish in Q4 2019. The nearest operational wind farm is Dudgeon OWF, which is situated 57.7 km to the South of the array area.

6.12.3.4 The closest consented but yet to be constructed offshore wind farm to Hornsea Four is Hornsea Project Two, which is directly adjacent as the array areas share a boundary (see **Figure 6-62)** Hornsea Project Two is scheduled to commence construction in the middle of 2020.

Hornsea Four
Offshore Wind Farms And Submarine Cables In Close Proximity To Hornsea Four
Figure 6.62



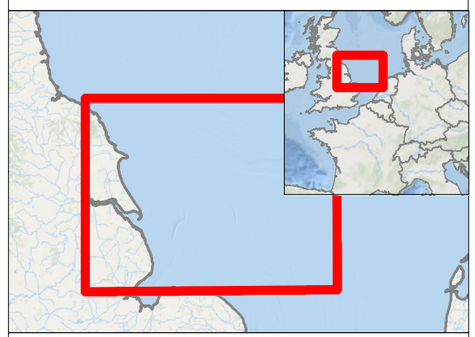
Scoping Boundary

Array Area

Offshore Wind Farms

Viking Link Cable Corridor, National Grid Electricity Transmission plc, V10

Submarine Cables



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:985000

0 5 10 20 30 40 Kilometres

0 4 8 16 24 Nautical Miles

Contains: TCE data © 2018; OceanWise Marine Themes data © 2018; KIS-ORCA Data © 2018; DITBI Data © 2018; and EADBR Data © 2018.

Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Date: 03-Oct-18 Author: laurenkirkland Name: H4SR_IN01_OWF and Submarine Cables_A3Land_ETRS89

Offshore Wind Farms And Submarine Cables In Close Proximity To Hornsea Four
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Cables

6.12.3.5 Existing and proposed subsea cables (electricity interconnectors and telecommunications cables) are shown in **Figure 6-62.**

6.12.3.6 The only submarine cable that will cross the proposed boundaries of the Hornsea Four array area is the proposed Viking Link cable. This is a proposed high voltage direct current (DC) electricity interconnector, 770 km long, between Bicker Fen in Lincolnshire and the substation at Revsing in southern Jutland, Denmark being developed jointly by National Grid and Energinet. Construction of the Viking Link is currently due to commence in 2019, with the cable becoming operational in 2022.

6.12.3.7 In addition there are several sections of what are assumed to be out of service submarine cables within the offshore ECC (see **Figure 6-62**); the operators of these cables are not currently known but will be confirmed through further data gathering and consultation.

CCS and natural gas storage

6.12.3.8 The proposed Endurance saline deposit reservoir overlaps in part with the Northern part of the Hornsea Four array area and offshore extent of the offshore ECC (see **Figure 6-63)**

6.12.3.9 Endurance is an underground "saline aquifer" storage reservoir which is the identified CO2 store for the White Rose CCS project being promoted by Capture Power Limited and National Grid Carbon Limited, to accept carbon produced by a proposed 448MW coal fired power station at the existing Drax site in North Yorkshire. The Planning Inspectorate (PINS) wensite records an application for a DCO for the power station project as having been refused by the Secretary of State in 2016, together with an application for the connecting pipeline to the offshore CO2 storage site which is noted as having been refused in 2017. There are currently no active CCS projects that would make use of the Endurance reservoir.

6.12.3.10 There are no other proposed CCS developments or natural gas storage sites within the Hornsea Four array area or ECC.

Disposal Sites

6.12.3.11 Existing, licensed seabed disposal sites are shown in **Figure 6-63**

6.12.3.12 The Hornsea Project One and Hornsea Project Two offshore wind farm array areas are also designated for the disposal of any material generated during the construction phase of each project with further disposal sites licensed along the connecting export cable corridor for those projects.

6.12.3.13 The Babbage disposal site lies 2.3 km to the East of the Hornsea Four array area. This site was opened to receive material produced from the installation of a pipeline in this area in 2009.

6.12.3.14 The Bridlington Bay B disposal site is located within the offshore ECC. Prior to the mid-1980's, Bridlington Bay B was used for the disposal of dredged material, but activity was shifted to Bridlington A to accommodate concerns from the fishing industry that the site was accumulating silty material. Bridlington A is used for the disposal of material produced

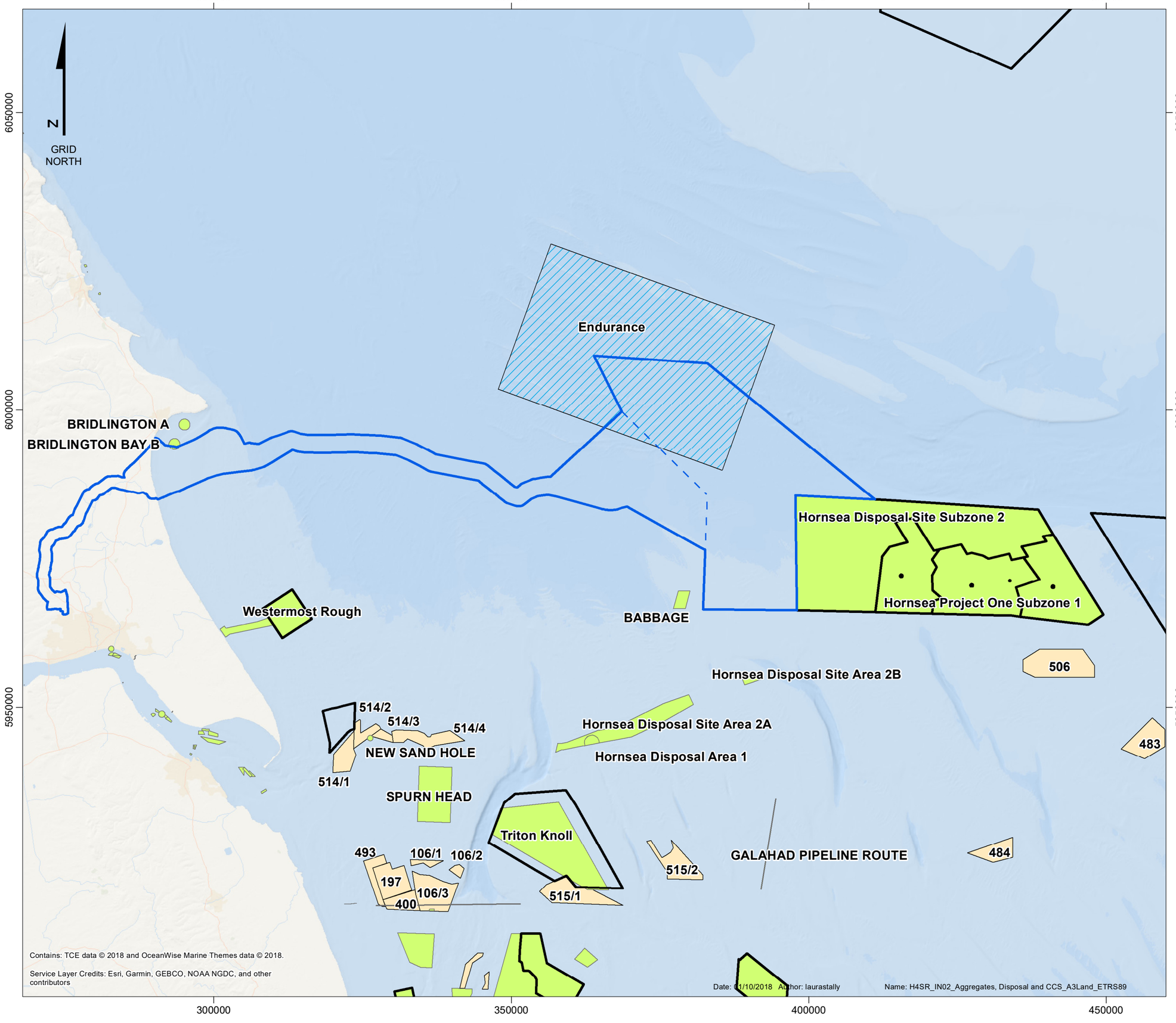
by maintenance dredging at the port of Bridlington, and is situated 2 km to the North of the offshore ECC.

Aggregate Extraction Sites

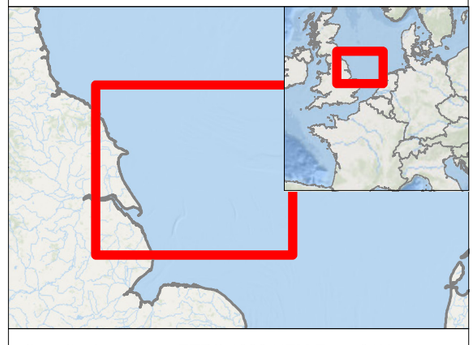
6.12.3.15 There are currently no licensed aggregate extraction sites within the Hornsea Four array area or the offshore ECC (see **Figure 6-63**). The closest licensed area is Area 506 which lies approximately 39 km to the Southeast of the Hornsea Four array area.

6.12.3.16 There are no known aggregate licence application or option areas within the Hornsea Four infrastructure and other marine users study area.

Hornsea Four
Marine Aggregate Extraction Sites, Disposal Sites And Carbon Capture and Storage Sites In Close Proximity
Figure 6.63



- Scoping Boundary
- Array Area
- Offshore Wind Farms
- Carbon Capture and Storage
- Disposal Sites
- Marine Aggregates



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:615000

0 3 6 12 18 24 30 Kilometres

0 3 6 12 18 Nautical Miles

Marine Aggregate Extraction Sites, Disposal Sites And Carbon Capture and Storage Sites In Close Proximity
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6.12.3.17 Chemical weapons and munitions have been dumped at sea since the end of World War One. The UK Offshore Energy SEA does not report any chemical munitions disposal sites in the Regional Sea encompassing the Hornsea offshore wind farm projects (DECC, 2011c).

MoD PEXAs

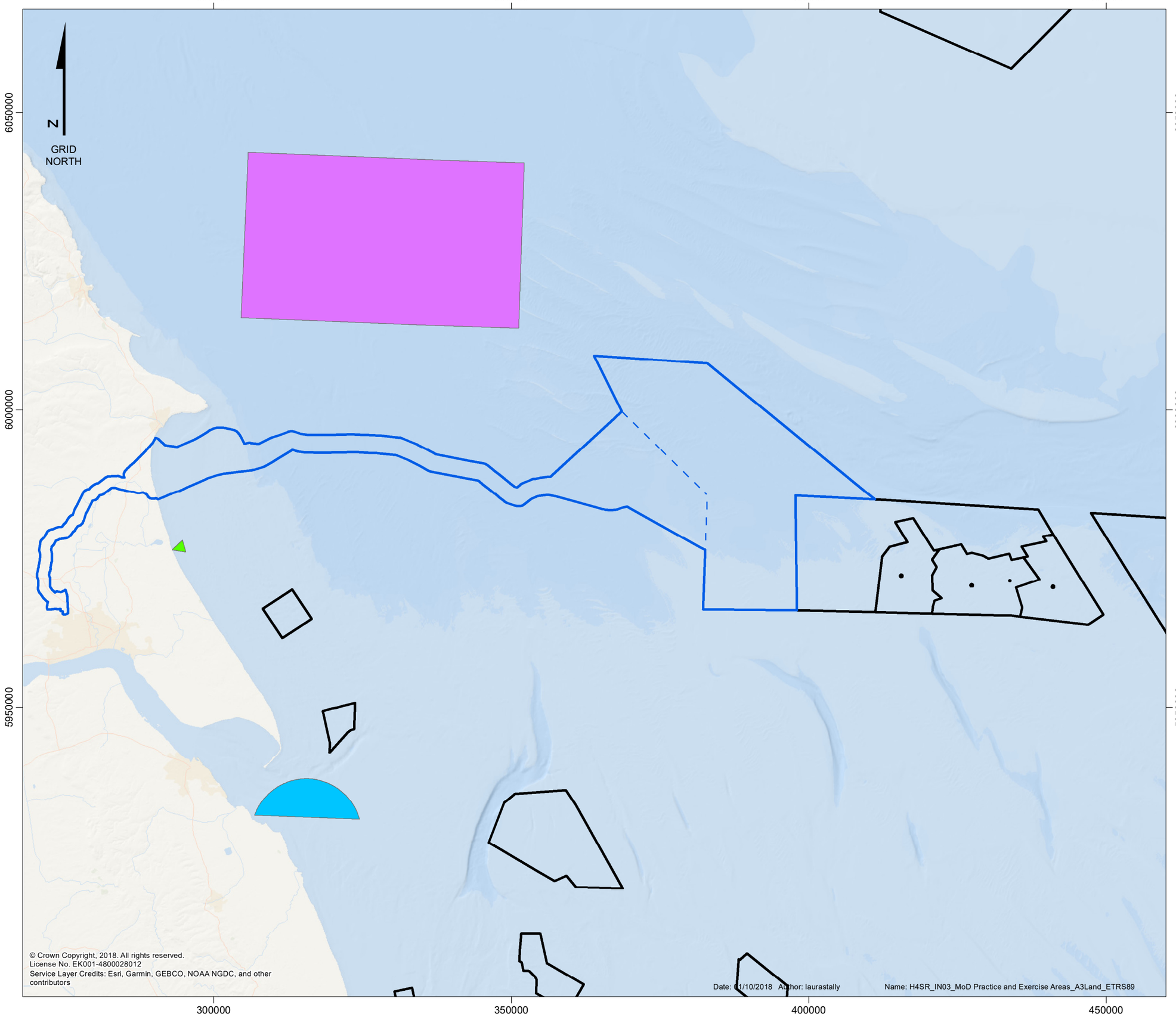
6.12.3.18 A PEXA (Practice and Exercise Area) is a designated offshore area which can be used by the Army, Air Force or Navy for firing practice and exercises. The Ministry of Defence (MoD) uses all uncontrolled UK airspace above Flight Level (FL) 195 for Army, Air Force and Navy training. Hornsea Four is located in uncontrolled airspace and beneath a PEXA.

6.12.3.19 PEXAs coincident with and in close proximity to the Hornsea Four array area and offshore ECC are shown in **Figure 6-64** and **Table 6-44**.

Table 6-44: PEXAs within the infrastructure and other marine users study area

Area Type	Approximate Distance from Hornsea Four
Firing danger area, small arms firing range, surface danger area	8.5 km to the South of the offshore ECC
Submarine Exercise Area	18.8 km to the North of the offshore ECC
Surface danger area, firing danger area	52.5 km to South of the offshore ECC

Hornsea Four
MoD Practice and Exercise Areas (PEXAs)
Figure 6.64



Scoping Boundary

Array Area

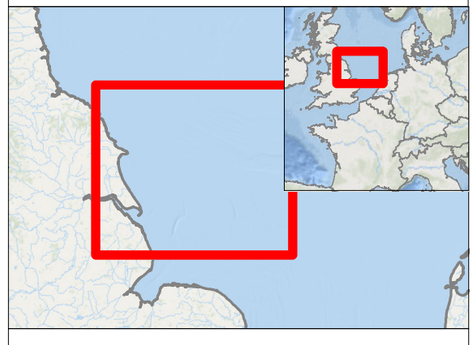
Offshore Wind Farms

Practice and Exercise Areas (PEXA) Categories

Firing Danger Area, Small Arms Firing Range, Surface Danger Area

Submarine Exercise Area

Surface Danger Area, Firing Danger Area



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:615000

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0 3 6 12 18 Nautical Miles

MoD Practice and Exercise Areas (PEXAs)
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6.12.3.20 Licenses for the exploration and extraction of oil and gas on the UK Continental Shelf have been offered since 1964 and are granted by the Oil and Gas Authority (OGA). These licences are granted for identified geographical United Kingdom Hydrographic Office (UKHO) areas (blocks and sub-blocks) in consecutive rounds, with the most recent being the 30th licensing round (blocks offered May 2018), with the 31st licensing round launched in July 2018.

6.12.3.21 The main type of offshore licence is the Seaward Production Licence. This may cover the whole, or part of a specified block or a group of blocks, and grants exclusive rights to the holders 'to search and bore for, and extract petroleum' (including gas) in the area covered by the licence. The traditional licence (the most common type of Seaward Production Licence, has an initial term of four years, though can be renewed for a further four years with a third term of 18 years. Longer terms may apply in certain areas. Exclusive rights may also include retained rights within an existing licenced acreage.

6.12.3.22 **Figure 6-65** presents the licence blocks located within or surrounding the Hornsea Four array area and offshore ECC. Block 43/27a is located in its entirety within the Hornsea Four array area and is operated by Premier Oil E&P UK EU Ltd. Block 43/26b is located almost entirely within the Hornsea Four array area, with a small portion crossing into the ECC. The operator for this block is BP Exploration Operating Company Ltd. There are an additional 9 licensed blocks coincident with the array area, and one further block within 500m of the array area, operated by BP Exploration Operating Company Ltd, Perenco UK Ltd, Premier Oil E&P UK EU Ltd, Ineos Clipper South C Ltd, and Holywell Resources Ltd. There are 9 open licence blocks coincident with the Hornsea Four array area.

6.12.3.23 There are 12 currently licenced blocks coincident with the Hornsea Four offshore ECC, operated by BP Exploration Operating Company Ltd, Perenco UK Ltd, Premier Oil E&P UK EU Ltd and Dana Petroleum plc. There are 11 open licence blocks within the Hornsea Four offshore ECC.

6.12.3.24 Areas with hydrocarbon potential have been extensively explored, with many fields brought into production in the Southern North Sea. There is a consensus view that the great majority of large fields in shelf depth waters (<200 m) have already been discovered (DECC, 2011), however with technological advances in seismic processing and drilling techniques new fields are still being discovered. Owing to the geology of the southern North Sea, the hydrocarbon fields in this region are gas or gas condensate fields rather than oil fields.

Seismic Surveys

6.12.3.25 Seismic survey operations may be carried out by the oil and gas industry in order to identify sub-surface geological structures that might hold reserves of oil and gas. The technique involves releasing pulses of acoustic energy along designated survey lines with the energy penetrating the sub-surface rocks and being reflected back to the surface where it can be detected by acoustic transducers and relayed to a recording vessel.

6.12.3.26 Subsea noise generated by piling activities during the construction phase of Hornsea Four has the potential to interfere with the seismic acoustic signal whilst the presence of the project during construction, operation and decommissioning phases may interfere with the conduct of planned seismic surveys.

6.12.3.27 All planned seismic surveys that are due to take place prior to the commencement of the construction phase of Hornsea Four have been screened out of this assessment. There is only one known, currently planned seismic survey (or geophysical surveys) that has the potential to occur during the construction phase of Hornsea Four; an application for consent has been made to undertake a geophysical survey (sub-bottom profiler pinger survey, sub-bottom profiler CHIRP Survey) in licence block 47/2, located 6 km to the South of the offshore ECC. However, it is recognised that further surveys may be planned during the development phase of Hornsea Four and consultation with relevant licence block holders will required to identify potential seismic survey activity.

Surface Structures

6.12.3.28 Oil and gas related surface structures include permanent and temporary structures. Permanent infrastructure includes gas platforms while temporary structures include drilling rigs and vessels. Relevant information about temporary structures will be ascertained from consultation with the relevant operators during the pre-application phase and to support the EIA process.

6.12.3.29 The Babbage and Ravenspurn North gas fields are located within the proposed project boundary, within which are situated the active Babbage gas platform within the Hornsea Four array area and six active platforms within the scoping area for the offshore ECC: Ravenspurn: North ST2; North CC; North ST3; North CCW; South A and South B (see **Figure 6-66** and **Figure 6-67**). Gas platforms are protected by a 500 m safety zone.

6.12.3.30 There are a total of 18 platforms within 9 NM of the array area (the range within which consultation with the platform operators is required with respect to the potential impacts on helicopter operations to and from these platforms). The presence of the Hornsea Four turbines has the potential to affect these helicopter operations; this issue is addressed separately in **section 6.10** Aviation and Radar.

6.12.3.31 Certain of the surface platforms will also have Radar Early Warning Systems (REWS) which act to monitor shipping and mitigate against vessel collision risk with the platforms. Hornsea Four has the potential to interfere with the operation of the REWS. The location and specifications of REWS will be determined through consultation with the relevant operators during the pre-application phase and to support the EIA process.

6.12.3.32 Surface vessel interactions with oil and gas platforms and the impacts of Hornsea Four on vessel collision risk are addressed separately in **section 6.9** Shipping and Navigation.

Subsurface Structures

6.12.3.33 Subsurface structures (excluding wells, see below for further detail) include protective structures, pipe junctions, manifolds, wellheads, trees and valves. These subsurface structures (excluding wells) may be protected by a 500 m safety zone. Subsurface structures are shown in **Figure 6-66** and **Figure 6-67.**

6.12.3.34 There are three active subsurface structures within the Hornsea Four array area; two of which are wellheads with the third being a manifold. There are six active subsurface protective structures within the offshore ECC, three of which are tie-in structures, two are barrier valve covers and one is a concrete gravity structure

6.12.3.35 Wells are classified into four categories as described below:

- completed wells – when a well is completed it is ready for production (or injection);
- drilling wells – wells in the process of being drilled. These are temporary in nature, as drilling lasts several months. These could be one of the following:
  - Exploration well: A well drilled as part of an exploration programme for information gathering purposes, to determine the presence of oil and gas;
  - Appraisal well: A well drilled as part of an appraisal drilling programme which is carried out to determine the physical extent of reserves and the likely production rate of a field;
  - Production well: A well intended to produce gas from an already appraised field or reserve; or
  - Development well; A well drilled within a proved production field or area of an oil or gas reservoir, to the depth of a stratigraphic horizon known to be productive.
- plugged and abandoned wells - where work has ceased on a well because it has become non-productive or non-viable. The standard requirement when a well is to be plugged and abandoned is to remove the well head and cut and remove the casings 10 feet below the seabed (Oil and Gas UK, 2015). The well is plugged with cement plugs and salvage of all recoverable equipment is undertaken; and
- suspended wells – After initial drilling, a well may be temporarily suspended if an operator intends to carry out further operations at a later date. In this event the well head may be left protruding a metre or two above the seabed and a guide base is left on the seabed to facilitate re-entry.

6.12.3.36 Completed and drilling wells typically have a 500 m safety zone. Suspended, and plugged and abandoned wells do not have safety zones.

6.12.3.37 There are 29 wells located within the Hornsea Four array area, of which:

- 11 have been plugged and abandoned;
- 13 are designated as completed; and
- 5 are suspended.

6.12.3.38 There are two additional wells within 500 m of the Hornsea Four array area.

6.12.3.39 There are 76 wells located within the scoping area for the offshore ECC of which:

- 24 of which have been designated as completed;
- 2 as drilling;
- 9 as plugged and abandoned; and
- 41 as suspended.

Oil and Gas Pipelines

6.12.3.40 The active oil and gas pipelines that intersect the Hornsea Four array area and the offshore ECC are listed in **Table 6-45** and shown in **Figure 6-66** and **Figure 6-67**

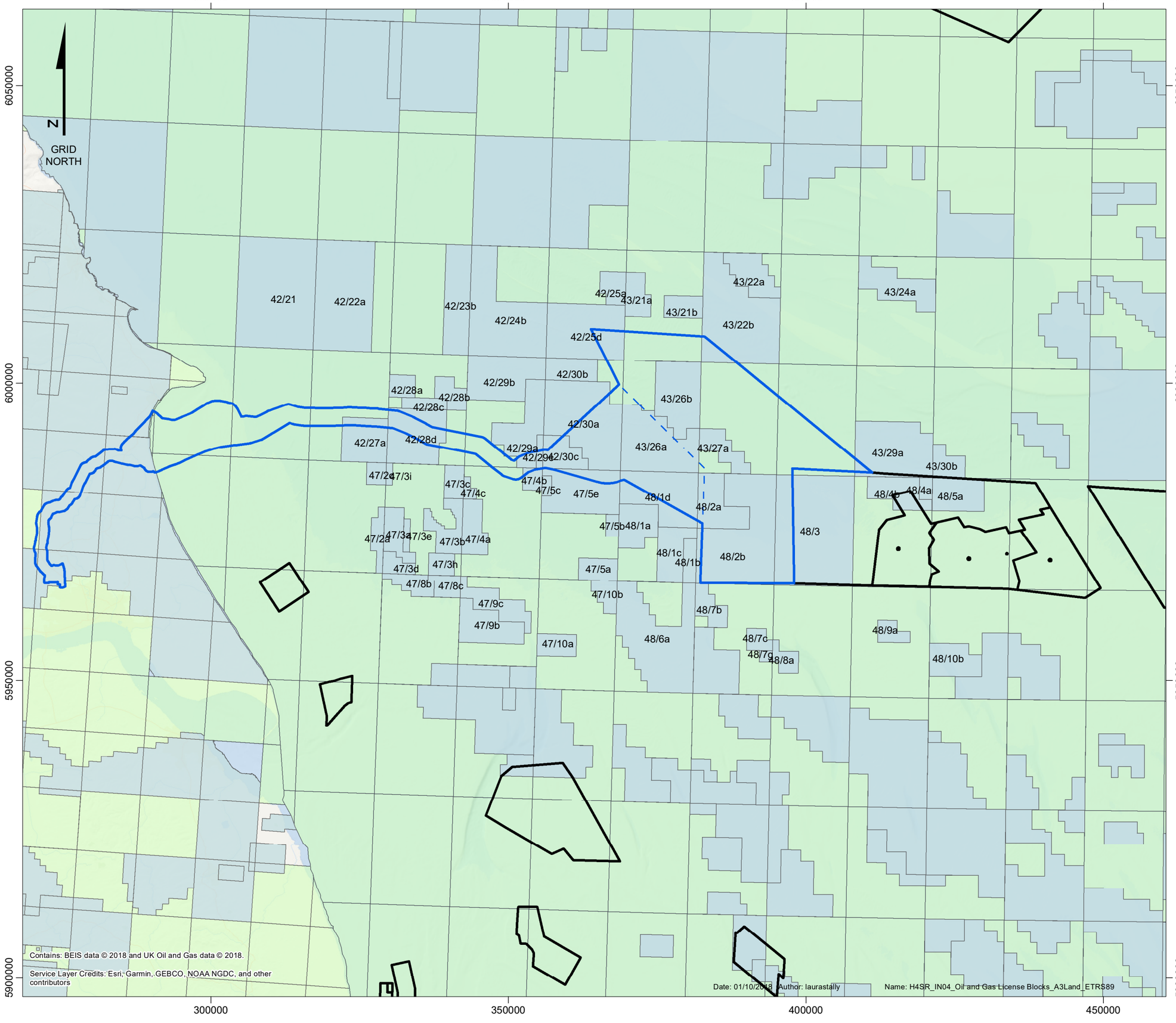
6.12.3.41 Pipelines are usually protected by a 500 m safety zone. Where Hornsea Four export, inter-array and interconnector cables will need to cross an active pipeline, a commercial 'crossing agreement' will be entered into with the pipeline operator. This will be a formal commercial arrangement that establishes the responsibilities and obligations of both parties and allows operations to be managed safely. A crossing agreement based upon the Oil and Gas UK 'Oil and Gas Crossing Agreement Template' will be used for the pipeline crossings. Where Hornsea Four cables will come within 500 m of an active pipeline, a commercial 'Proximity Agreement' will be entered into with the pipeline operator. This, in

the same way as the crossing agreement, will establish the responsibilities and obligations of both parties and allows operations to be managed safely.

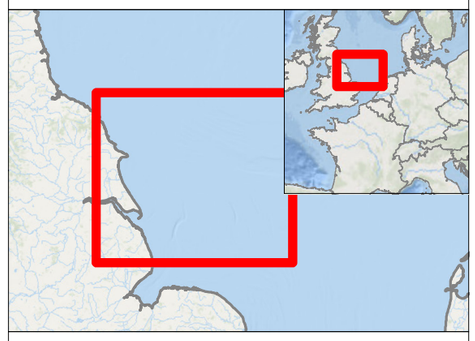
Table 6-45: Oil and gas pipelines running through the proposed Hornsea Project Four array area and offshore ECC

Pipeline	Status
Hornsea Four Array Area	
Johnston Field umbilical/export/methanol lines	Active
Babbage export line	Active
Theddlethorpe to Murdoch MD gas line	Active
Theddlethorpe to Murdoch MD MeOH line	Active
Shearwater to Bacton line	Active
Offshore ECC	
Ravenspurn North gas export line	Active
Minerva to Cleeton gas export line	Active
Cleeton to Minerva umbilical	Active
Minerva to Cleeton piggy	Active
Neptune to Cleeton gas line	Active
Cleeton CP to Dimlington gas export line	Active
Langeled gas pipeline	Active

Hornsea Four
Oil and Gas Licence Blocks in the Infrastructure and Other Marine Users Study Area
Figure 6.65



- Scoping Boundary
- Array Area
- Offshore Wind Farms
- Licensed Blocks
- Unlicensed Blocks



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:615000

0 3 6 12 18 24 30 Kilometres

0 3 6 12 18 Nautical Miles

Oil and Gas Licence Blocks in the Infrastructure and Other Marine Users Study Area
Document no: H4SR_IN04
Created by: NC
Checked by: CC
Approved by: LK

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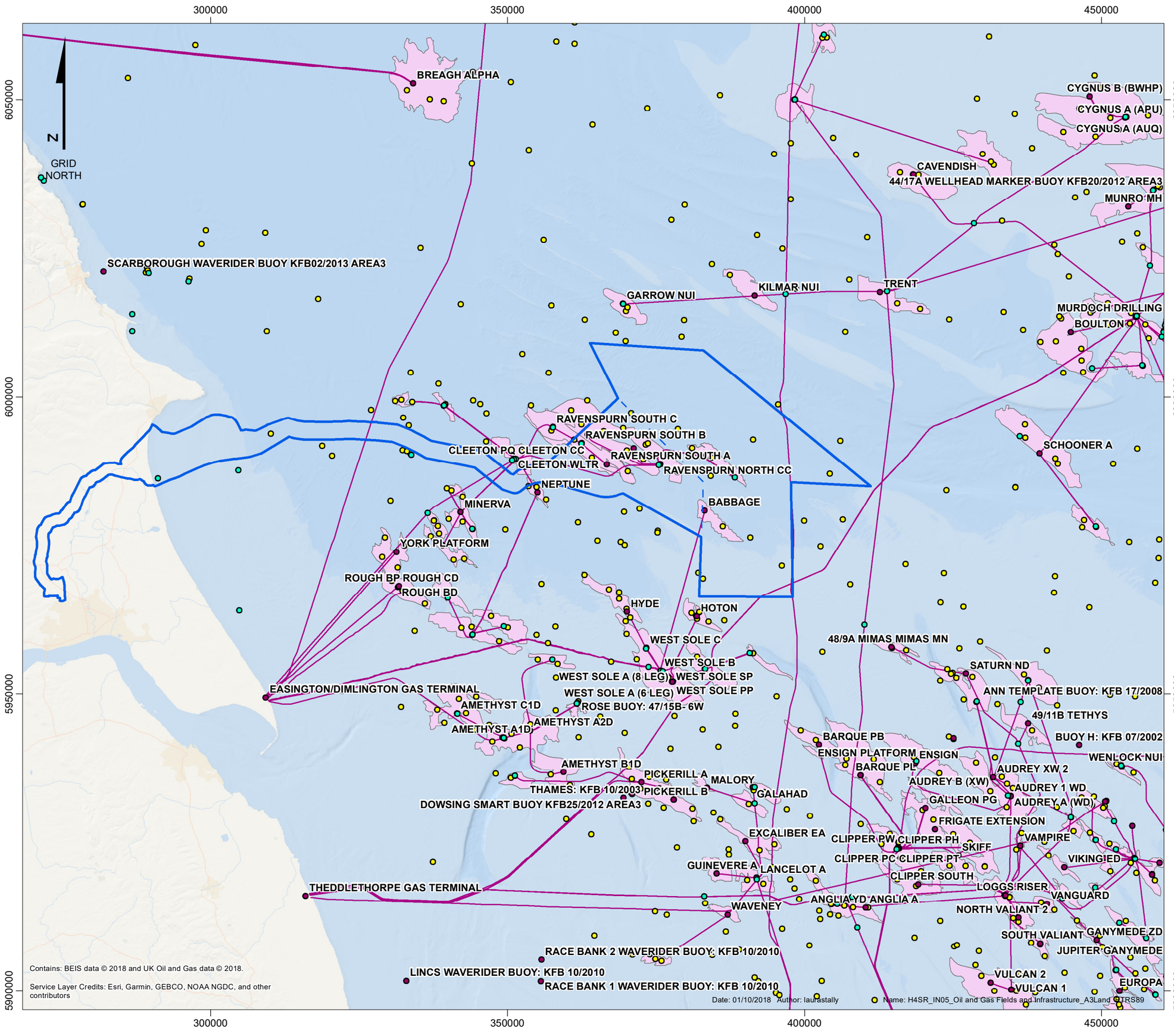
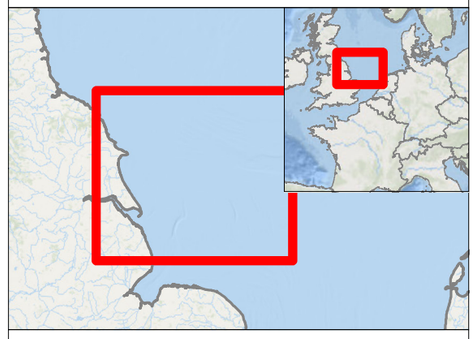
Hornsea Four

Oil and Gas Fields and Infrastructure in Close Proximity to Hornsea Four

Figure 6.66



- Scoping Boundary
- Array Area
- Oil and Gas Subsurface Infrastructure
- Oil and Gas Surface Infrastructure
- Oil and Gas Wells
- Oil and Gas Pipelines
- Oil & Gas Fields



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:615000

0 3 6 12 18 24 30 Kilometres

0 3 6 12 18 Nautical Miles

Oil and Gas Fields and Infrastructure in Close Proximity to Hornsea Four
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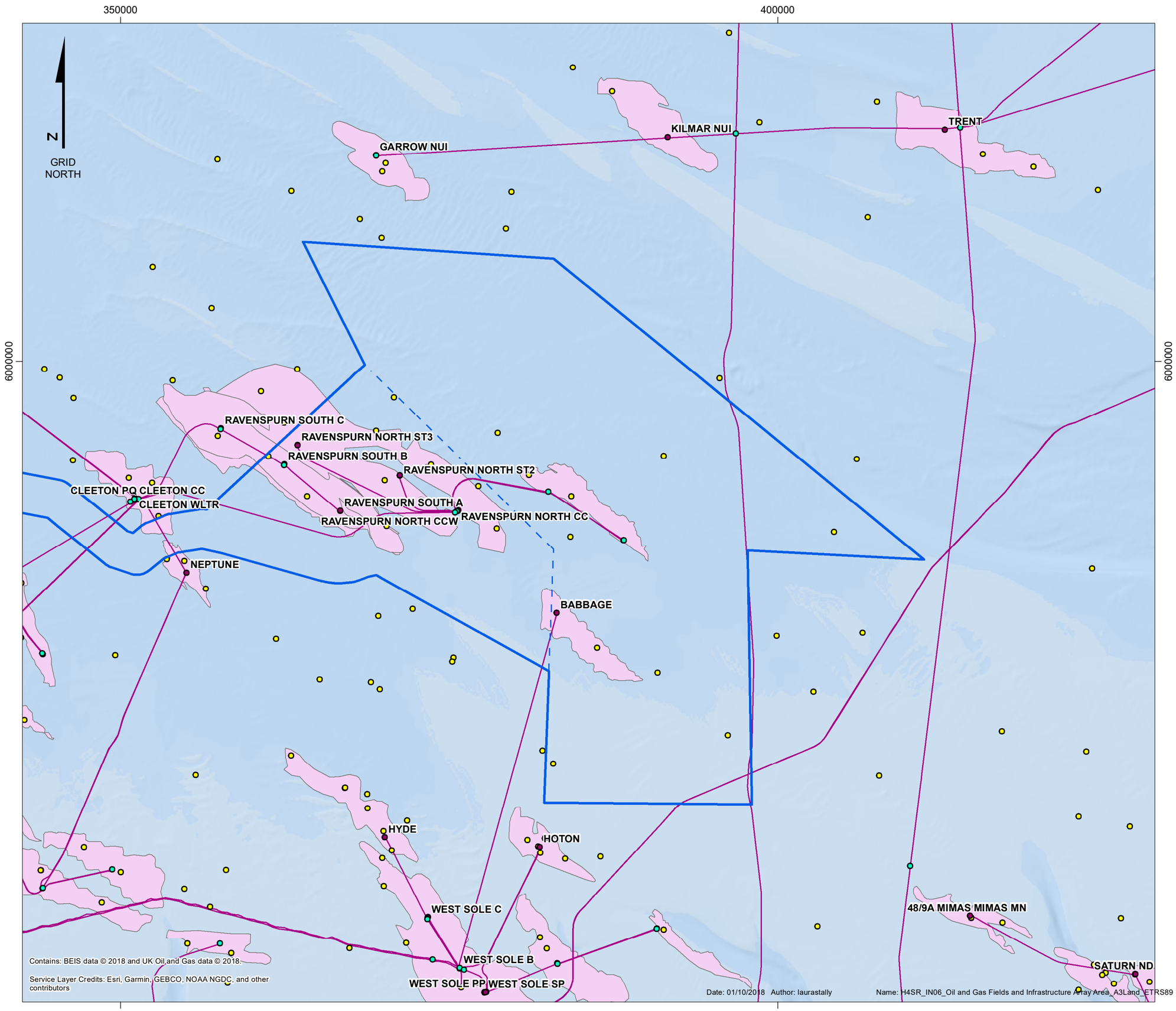
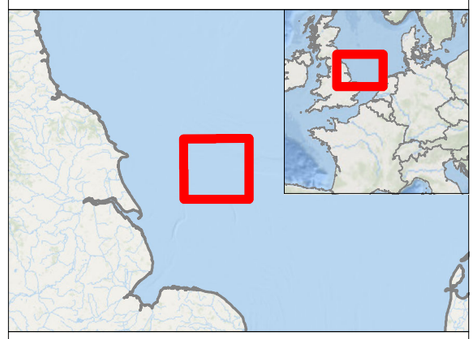
Hornsea Four
Oil and Gas Fields and Infrastructure Within the Vicinity of the Array Area
Figure 6.67



- Scoping Boundary
- Array Area
- Oil and Gas Subsurface Infrastructure
- Oil and Gas Surface Infrastructure
- Oil and Gas Wells
- Oil and Gas Pipelines
- Oil & Gas Fields



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:275650

0 1 2 4 6 8 10 12 Kilometres

0 1 2 4 6 Nautical Miles

Oil and Gas Fields and Infrastructure Within the Vicinity of The Array Area
Document no: H4SR_IN06
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Approved by: LK

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6.12.3.42 The key receptors for the infrastructure and other marine users scoping assessment may be summarised as follows (in no particular order):

- other offshore wind farms;
- existing cables;
- CCS and natural gas storage;
- disposal sites;
- chemical weapons and munitions;
- MoD PEXAs;
- aggregate extraction sites; and
- oil and gas operations: seismic surveys; surface structures; subsurface structures; and oil and gas pipelines.

6.12.3.43 The potential issues for infrastructure and other marine users across the Hornsea Four array area and offshore ECC, to be considered further in this scoping section, maybe be summarised as follows (in no particular order) and based on the characterisation of the baseline conditions:

- physical impacts on existing or proposed cables and pipelines (including the proposed Viking Link);
- potential interference with O&G operations (including seismic surveys, existing surface and sub-surface infrastructure, REWS and helicopter operations); and
- physical impacts with the proposed Viking Link subsea cable.

6.12.3.44 As there is no spatial overlap of wind farm infrastructure at the present time and the adjacent sites (Hornsea Project One and Hornsea Project Two) are being developed by the same proponent as Hornsea Four, the impact of Hornsea Four on the following aspects will be scoped out of any further consideration:

- potential interference with other wind farms;
- potential impacts on aggregate dredging activities (given the distance to the nearest licensed area);
- impacts on disposal sites (given the lack of spatial overlap with currently active disposal sites); and
- impacts on the proposed Endurance CCS site (given the status of projects linked to the CCS site).

6.12.4 Project Basis for Scoping Assessment

6.12.4.1 The infrastructure and other marine users scoping assessment is based on the following maximum design scenario:

- the construction and operation of up to 180 WTGs on gravity base structure foundations with associated seabed preparation and scour protection;
- the construction and operation of up to ten offshore substations, platforms, and accommodation platforms within the array area and up to three HVAC booster stations along the offshore ECC, all on gravity base structure foundations with associated seabed preparation and scour protection; and
- the construction of offshore export cables, inter-array cables, interconnector cables and associated cable protection.

6.12.4.2 The basis for assessment also includes the embedded mitigation (detailed in section 6.12.5 below) where appropriate.

6.12.5 Embedded Mitigation

6.12.5.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed to reduce the potential for impacts on infrastructure and other marine users. These are presented in Table 6-46. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in Annex A.

6.12.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in section 6.12.6 (i.e. the determination of the magnitude and therefore significance assumes implementation of these measures).

Table 6-46 - Relevant Infrastructure and Other Marine Users Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co89	Tertiary: Advance warning and accurate location details of construction/maintenance/decommissioning operations and associated Safety Zones and advisory safety distances will be given to fishing fleets (including via Notices to Mariners and Kingfisher Bulletins).	Secured in the dMLs through the requirements for notifications.
Co91	Tertiary: Guard vessels will be used, where appropriate, during construction/maintenance/decommissioning operations to ensure communication of and adherence to Safety Zones and advisory safety distances.	Secured in the dMLs through the requirement for a CMS and through the application for Safety Zones.
Co94	Tertiary: Notifications will be made to the relevant bodies (e.g. United Kingdom Hydrographic Office) to allow marking of all installed infrastructure on charts.	Secured in the dMLs through the requirements for notifications.
Co107	Tertiary: Crossing and proximity agreements with known existing pipeline and cables operators.	Secured by commercial agreements with pipeline and cable operators.
Co111	Tertiary: A PEMMP (construction and operation phases) and Decommissioning Plan (decommissioning phase) will be produced and followed. The PEMMP and Decommissioning Plan will cover the construction, operation and maintenance, and decommissioning phases of Hornsea Four respectively and will include a MPCP. This MPCP will outline procedures to protect personnel working and to safeguard the marine environment in the event of an accidental pollution event arising from offshore operations relating to Hornsea Four. The MPCP will also outline mitigation measures should an accidental spill occur, address potential contaminant releases and include key emergency contact details (e.g. Environment Agency, Natural England and the MCA.	Secured in the dMLs through the requirement for a PEMMP and Decommissioning Programme.
Co139	Tertiary: Application and use of safety zones of up to 500m during construction/maintenance and decommissioning phases.	Secured by the application for Safety Zones prior to the commencement of construction.

6.12.6 Likely Significant Effects

6.12.6.1 Table 6-47 sets out an assessment of effects on infrastructure and other users at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

6.12.6.2 The assessment presented in Table 6-47 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 6-46, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for infrastructure and other users effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in section 1.7; and the professional judgement of qualified infrastructure and other users practitioners.

6.12.6.3 Table 6-47 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

6.12.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 6-47: Likely Effects - Infrastructure and Other Marine Users

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Aggregate dredging activities	Given that there are no licensed aggregate dredging sites within 30+km to the Hornsea Four array area or offshore ECC, impacts on aggregate dredging activity will be scoped out of any further consideration in the EIA process.				**Scoped Out**	N/A
Disposal sites	As there are no active, licensed sites within or within 2km of the Hornsea Four array area (excluding the adjacent Hornsea One and Two sites) or offshore ECC, impacts on licensed disposal sites will be scoped out of any further consideration in the EIA process.				**Scoped Out**	N/A
Impacts on the proposed Endurance CCS site	Given the current status of the CCS projects in the UK (and the planning refusal of the White Rose CCS project), impacts on the Endurance CCS site will be scoped out of any further consideration in the EIA process.				**Scoped Out**	N/A
Construction phase: Impacts on existing or proposed pipelines or cables or restrictions on access to pipelines or cables	Tertiary Co89 Co91 Co97 Co107	Minor	Medium	**No likely significant effet**	**Scoped Out**	N/A
Construction phase: Conflicts with oil and gas seismic survey activity within the Hornsea Four array area.	Tertiary Co89 Co91 Co97	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it. In addition, safety zones and advisory safety distances around the Hornsea Four array area may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Construction phase: Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four array area and within 500 m of the boundary of the Hornsea Four array area.	Tertiary Co89 Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced areage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction phase: Conflicts with oil and gas seismic survey activity along the Hornsea Four offshore ECC.	Tertiary Co89 Co91 Co97	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC scoping area. Safety zones around the potential offshore HVAC booster station(s) and advisory safety distances along the Hornsea Four offshore ECC corridor may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Construction phase: Restriction on oil and gas drilling and the placement of infrastructure within the offshore ECC and within 500 m of the boundary of the Hornsea Four ECC.	Tertiary Co89 Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced areage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC search area.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Construction phase: The piling of wind turbines and substation foundations will generate underwater noise that may cause acoustic interference with oil and gas seismic survey operations.	Tertiary Co89 Co97	Low	Low	**Likely significant effect without secondary mitigation** Liely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance phase: Temporary loss of access to existing or proposed pipelines or	Tertiary Co89 Co91 Co97 Co107	Negligible	High	**No likely significant effect**	**Scoped Out**	N/A

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
cables for repair or maintenance.						
Operation and Maintenance phase: Conflicts with oil and gas seismic survey activity within the Hornsea Four array area.	Tertiary Co89 Co97	Dependent upon operator and location, timing and design of seismic surveys.	The senstivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are 10 currently licenced blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it. The presence of infrastructure within the Hornsea Four array area may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance phase: Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four array and within 500 m from the boundary of the Hornsea Four array area.	Tertiary Co89 Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced areage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are 10 currently licenced blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance phase: Conflicts with oil and gas seismic survey activity along the Hornsea Four offshore ECC.	Tertiary Co89 Co91 Co97	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are 12 currently licenced blocks coincident with the Hornsea Four offshore ECC search area. In the event that safety zones around the potential offshore HVAC booster station(s) are required during maintenance activities, these may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operation and Maintenance phase: Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four offshore ECC and within 500 m from the boundary of the Hornsea Four offshore ECC.	Tertiary Co89 Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced areage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are 12 currently licenced blocks coincident with the Hornsea Four offshore ECC search area.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance phase: Interference with the performance of the REWS located on oil and gas platforms.	Tertiary Co89 Co97	Dependent upon platform location, proximity, and the characteristics of the REWS sytem.	Potentially high where the performance of a REWS system is significantly affected.	**Likely significant effect without secondary mitigation** The presence of the Hornsea Four turbines in previously open sea has the potential to cause significant interference with the performance of REWS located on oil and gas platforms. There are several platforms with REWS in the vicinity of the Hornsea Four array area which have the potential to be affected by the wind turbines within it.	Scoped In Detailed Assessment. Consultation with each of the relevant platform operators will be undertaken to inform the assessment.	Consultation with each potentially affected platform operator will be undertaken to inform the assessment and identify and characterise REWS systems. Modelling of impacts on REWS will be undertaken by Manchester University.
Operation and Maintenance phase: The presence of new wind turbines in previously open sea areas will deviate vessels which may cause a change in Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) alarms on oil and gas platforms protected by REWS.	Tertiary Co89 Co97	Dependent upon platform location, proximity and the characteristics of the REWS systm and corresponding vessel routeing and activity.	Potentially high where risk of vessel collision is increased due to significant impacts on the performance of a REWS system.	**Likely significant effect without secondary mitigation** Dependant on location of platform and effects on REWS and corresponding change to vessel collision risk.	Scoped In Detailed Assessment. Consultation with each of the relevant platform operators will be undertaken to inform the assessment.	Consultation with each potentially affected platform operator will be undertaken to inform the assessment, and to identify and characterise REWS systems. Modelling of impacts on REWS will be undertaken by Manchester University. This will be integrated into the shipping and navigation assessment in relation to potential collision risk.
Operation and Maintenance phase: Wind turbines and associated infrastructure will form	Tertiary Co89 Co94 Co97	Dependent upon platform location and proximity and corresponding	Potentially high (for the Hornsea Four array) where vessel access to platforms and	**Likely significant effect without secondary mitigation** Dependent on location of platform and effects on vessel access relative to the Hornsea Four array.	Scoped In A simple assessment will be adopted (for Hornsea Four array only). Scoped out of	Consultation with each potentially affected platform operator will be undertaken to inform the assessment. To be

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
a physical obstruction and may disrupt vessel access to oil and gas platforms and subsurface infrastructure.		vessel routeing and activity.	subsurface infrastructure is restricted. No impact from Hornsea Four offshore ECC in operation.		further assessment for Hornsea Four offshore ECC.	informed by the Shipping and Navigation assessment process (see section 7.9).
Decommissioning phase: Impacts on existing or proposed pipelines or cables or restrictions on access to pipelines or cables	Tertiary Co89 Co91 Co97 Co107 Co111 Co139	Minor	High	**No likely significant effect**td	**Scoped Out**	N/A
Decommissioning phase: Conflicts with oil and gas seismic survey activity within the Hornsea Four array area.	Tertiary Co89 Co91 Co97 Co111	Dependent upon operator and location, timingand design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it. In addition, safety zones and advisory safety distances around the Hornsea Four array area may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each of the relevant platform operators will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decommissioning phase: Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four array area and within 500 m of the boundary of the Hornsea Four array area.	Tertiary Co89 Co97 Co111	Deendent upon operator.	The sensitivity of he receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decommissioning phase: Conflicts with oil and gas seismic survey activity along the	Tertiary Co89, Co97 Co111	Dependent upon operator and location, timingand design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic	Scoped In A simple assessment approach will be adopted. Consultation with each potentially	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA.

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Hornsea Four offshore ECC.			requirements of the operators of each potentially affected block.	survey requirements is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC scoping area. Safety zones around the potential offshore HVAC booster station(s) and advisory safety distances along the Hornsea Four offshore ECC corridor may have an impact on the conduct of seismic surveys in the vicinity.	affected licence block operator will be undertaken to inform the assessment.	In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decommissioning phase: Restriction on oil and gas drilling and the placement of infrastructure within the offshore ECC and within 500 m of the boundary of the Hornsea Four ECC.	Tertiary Co89 Co97 Co111	Deendent upon operator.	The sensitivity of he receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC search area.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decommissioning phase: The piling of wind turbines and substation foundations will generate underwater noise that may cause acoustic interference with oil and gas seismic survey operations.	Tertiary Co89 Co97 Co111	Lo	Low.	**Likely significant effect without econdary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged.	Scoped In A simple assessment approach will be adopted. Underwater noise modelling will also be undertaken to inform the assessment. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.

6.12.7 Impacts Scoped Out of Assessment

Impacts on existing or proposed pipelines or cables or restrictions on access to pipelines or cables for repair and maintenance (construction, operational and decommissioning phases)

6.12.7.1 Typically, the area impacted by offshore wind farm infrastructure affects a small proportion of the total development area. The EIA for adjacent Hornsea projects have predicted that impacts on existing or proposed cables and pipelines would not result significant effects; effects on existing cables and pipelines as a result of Hornsea Four are similarly predicted to be not significant. Cable/pipeline crossing and proximity agreements will be established with relevant operators as embedded measures which will ensure access for cable or pipeline repair and maintenance. It is therefore proposed that this impact is scoped out of the EIA.

Aggregate dredging activities.

6.12.7.2 Given that there are no licensed aggregate dredging sites within 30+km to the Hornsea Four array area or offshore ECC, impacts on aggregate dredging activity have been scoped out of any further consideration in the EIA process. Assessment of adjacent Hornsea projects showed that Aggregate extraction was scoped out within 16km of the developments, far closer than the nearest identified aggregate dredging site for Hornsea Project Four.

Disposal site activities.

6.12.7.3 As there are no active, licensed sites within 2km of the Hornsea Four array area or offshore ECC (with the exception of the adjacent Hornsea One and Two project areas), impacts on licensed disposal sites will be scoped out of any further consideration in the EIA process.

Impacts on proposed Endurance CCS Site.

6.12.7.4 Given the current status of the CCS projects in the UK (and the planning refusal of the White Rose CCS project), impacts on the Endurance CCS site will be scoped out of any further consideration in the EIA process. The EIA for adjacent Hornsea projects also identified as there are no active or proposed CCS, natural gas storage or UCG sites within the relevant infrastructure and other users study area resulting in the assessment of effects on these receptors being scoped out.

6.12.8 Proposed Approach to the PEIR and ES

6.12.8.1 A desk study will be conducted, supported by consultation with relevant stakeholders and operators, to establish the relevant status of the known and foreseeable offshore infrastructure and other marine user activity that may occur within the vicinity of Hornsea Four, and which may be subsequently impacted by the development activities. Consultees will include, though not necessarily be limited to:

- existing and proposed pipeline and cable operators;
- oil and gas operators; and
- the MoD for PEXA issues.

6.12.8.2 Existing and planned licenced activity will be identified and any potential for conflict for the project alone or cumulatively will identified and assessed for those impacts scoped in to the assessment process.

6.12.8.3 Due consideration will also be given to the potential for transboundary effects as well as assessing the inter-relationships that may exist for the topic area.

6.12.9 Scoping Questions for Consultees

6.12.9.1 Scoping questions for consultees in relation to infrastructure and other users include:

1. Do you agree that the data sources identified are sufficient to inform the infrastructure and other marine users baseline for the Hornsea Four PEIR and ES?
2. Have all potential impacts resulting from Hornsea Four been identified for infrastructure and other marine users?
3. Do you agree with the proposed approach to assessment (scoped in or out, and detailed or simple assessment) for each of the impacts in Table 6-47.
4. Do you agree that impacts on other offshore wind farms, aggregate dredging, disposal sites and CCS projects should be scoped out entirely due to the lack of proximity of relevant receptors to the Hornsea Four array and area and offshore ECC?
5. Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of Hornsea Four on infrastructure and other marine users receptors?
6. For the impacts scoped in, do you agree that the methods described are sufficient to inform a robust impact assessment?

7 Environmental Topics and Potential Effects Onshore

The scoping boundary has been used differently in the onshore assessment presented in this chapter of the Scoping Report because there is greater design certainty regarding the route of the onshore ECC. The basis for the onshore scoping exercise is described below and illustrated in **Figure 7.1**.

- Onshore substation: The onshore substation search area, which is a constituent part of the scoping boundary, has been used for data collection and for scoping.

- Onshore ECC: Within the scoping boundary there is a 200 m indicative permanent cable area and a 700 m indicative temporary works area. Due to the greater design certainty, the 700 m indicative temporary works area has been used for scoping and topic-specific study areas have generally been taken from the edge of this buffer rather than the scoping boundary. The scoping boundary has been used for the purposes of data collection.

- Landfall: The landfall search area, which is a constituent part of the scoping boundary, has been used for data collection and scoping.

500000 510000 520000

460000 450000 440000

Landfall Search Area

Onshore Export Cable Corridor (ECC)

Onshore Substation Area

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GRID NORTH

Service Layer Credits: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Name: H4SR_7.1_Horsea4OnshoreBoundary_A3Por_BNG Date: 08/10/2018 Author: ERM

Scoping Boundary
Scoping Boundary Component
Indicative Permanent Cable Area
Indicative Temporary Works

Please note that the indicative permanent and indicative temporary cable areas could be placed anywhere within the scoping boundary should new constraints/sensitivities arise based on feedback received in the Scoping Opinion and through ongoing stakeholder dialogue.

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

Hornsea Four Onshore Scoping Boundary and Indicative Temporary and Permanent Works

Figure: 7.1

Document no: H4SR_7.1
Created by: AA
Checked by: CB
Approved by: NL

ERM Ørsted

7.1 Geology and Ground Conditions

7.1.1 Introduction

7.1.1.1 This section of the Scoping Report identifies the onshore geology and ground conditions of relevance to Hornsea Four and considers the potential effects from construction, operation, maintenance and decommissioning activities of the onshore components (i.e. landward of MHWS). Due to the nature of Hornsea Four (i.e. underground cable route with limited above-ground permanent infrastructure); the potential for likely significant effects on soils and geology is largely limited to the construction phase because the cable will be buried. Impacts on geology and ground conditions includes consideration of secondary effects on human health (construction workers) as well as the environment.

7.1.2 Study Area

7.1.2.1 The Study Area for the geology and ground conditions scoping assessment considers the 700 m wide onshore ECC (which contains the 200 m wide Indicative Permanent Cable Area and the 700 m wide Indicative Temporary Works Area) and the landfall and substation search areas as shown in **Figure 7-2** and any relevant sources (e.g. potentially contaminated land) or receptors (minerals safeguarding zones) within these areas.

7.1.2.2 The Study Area for geology and soils extends beyond the above areas where necessary to provide context and include features within the areas but which also extend beyond them. The geology and ground conditions seaward of MHWS are addressed in Chapter 6 Environmental Topics and Potential Effects Offshore. It should be noted that the Study Area will be reviewed and amended in response to the refinement of the landfall, onshore ECC and onshore substation areas and the identification of any additional potential contaminative sources, pathways (e.g. watercourses) and receptors.

500000
510000
520000
460000
450000
440000

Skipsea Bail Mere Site of Special Scientific Interest

Withow Gap Site of Special Scientific Interest

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GRID NORTH

Sources: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Name: H4SR_7.2_GeologyPotentialAreasContaminationSensitiveAreas_A3Por_BNG

Date: 08/10/2018

Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works
- Site of Special Scientific Interest (Natural England)
- Potentially Contaminated Land (East Riding of Yorkshire Council)
- Adopted Minerals Safegaurding Areas (East Riding of Yorkshire Council)

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

Potential Areas of Contamination and Sensitive Areas

Figure: 7.2

Document no: H4SR_7.2
Created by: AA
Checked by: SR
Approved by: NL

ERM

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7.1.3 Baseline Environment

7.1.3.1 Data Sources used for Scoping

7.1.3.2 An initial desk study was undertaken to obtain information on geology, hydrogeology, ground conditions and protected sites relevant to geology and ground conditions. Data were requested within the onshore scoping boundary. The following sources of information in Table 7-1 were consulted.

Table 7-1 Key Sources of Geology and Ground Conditions Data

Source	Summary	Coverage of Hornsea Four development area
British Geological Survey (BGS)	1:50,000 geological mapping 55/65 Flamborough and Bridlington, 64 Great Driffield and 72 Beverley. BGS onshore geoindex map (http://mapapps2.bgs.ac.uk/geoindex/home.html	Full coverage of the Hornsea Four onshore scoping boundary.
DEFRA	MAGIC map (www.magic.defra.gov.uk);	Full coverage of the Hornsea Four onshore scoping boundary.
ERYC	Adopted minerals safeguarding areas and potentially contaminated land areas	Full coverage of the Hornsea Four onshore scoping boundary.
Natural England	Designated Sites (www.designatedsites.naturalengland.org.uk	Full coverage of the Hornsea Four onshore scoping boundary.

7.1.3.3 Site-specific data will be reviewed from an environmental database (i.e. Landmark Envirocheck report) once the landfall, onshore ECC and onshore substation search areas have been refined. A targeted walkover of areas of interest will be undertaken as part of the PEIR if the desk-based review indicates this is necessary.

Geology

7.1.3.4 An initial review of the BGS geology maps indicates that there is no artificial ground within the onshore scoping boundary. The BGS geology maps show that various superficial deposits underlie the onshore scoping boundary, as shown in Figure 7-3. These deposits include (from oldest to youngest deposit age):

- Till (Diamicton);
- Glaciofluvial Deposits (Sand and Gravel)
- River Terrace Deposits (Sand and Gravel); and
- Alluvium (Clay, Silt and Sand).

7.1.3.5 The superficial deposits are underlain by chalk bedrock, belonging to the White Chalk Subgroup. The BGS geology maps shows the bedrock within the onshore scoping boundary to comprise the following formations (from oldest to youngest bedrock age):

- Burnham Chalk Formation;
- Flamborough Chalk Formation; and
- Rowe Chalk Formation.

500000 510000 520000

460000 450000 440000

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GRID NORTH

Sources: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China

Name: H4SR_7.3_GeologySuperficial_A3Por_BNG

Date: 08/10/2018 Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works

Superficial Geology UK 625k (British Geological Survey)

- ALLUVIUM - CLAY, SILT AND
- BRICKEARTH - SILT
- BLOWN SAND - SAND AND
- CRAG GROUP - SAND AND GRAVEL
- CLAY-WITH-FLINTS FORMATION - DIAMICTON
- GLACIOLACUSTRINE DEPOSITS - CLAY, SILT AND SAND
- LACUSTRINE DEPOSITS - CLAY
- PEAT-PEAT
- RAISED MARINE DEPOSITS - SAND AND GRAVEL
- RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - SAND AND GRAVEL
- SAND AND GRAVEL OF UNCERTAIN AGE AND ORIGIN - SAND AND GRAVEL
- LANDSLIDE DEPOSITS - UNKNOWN/UNCLASSIFIED ENTRY
- TILL- DIAMICTON
- UNKND-UNKNOWN

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

Superficial Geology of Hornsea Four

Figure: 7.3

Document no: H4SR_7.3
Created by: AA
Checked by: SR
Approved by: NL

ERM Ørsted

Hydrogeology

7.1.3.6 The Environment Agency classifies the Glaciofluvial Deposits, River Terrace Deposits and the Alluvium as 'Secondary A' aquifers, meaning they may provide locally important groundwater resources. The superficial till deposits within the scoping boundary are classified as 'Secondary Undifferentiated' aquifers (DEFRA Magic Map, 2018).

7.1.3.7 The chalk bedrock within the onshore scoping boundary is classified by the Environment Agency as a 'principal' aquifer (DEFRA Magic Map, 2018). These aquifers may provide water supply and river base flow on a strategic / regional level. The chalk aquifer is classified by the Environment Agency as 'Hull and East Riding Chalk' groundwater body under the Water Framework Directive (Directive 2000/60/EC) (European Union, 2000). The current overall status of the body is 'poor' due to poor nutrient management, sewage discharge and other industrial activities within the groundwater catchment, as well as saline intrusion near coastal areas. However, as noted in the following paragraphs, the groundwater body is used for public water supply, as well as other abstraction users.

7.1.3.8 Groundwater resources can be susceptible to land-based contamination sources depending on the nature of the deposits. The Environment Agency classifies the alluvium as 'Medium' and the glaciofluvial deposits as 'Medium-High' vulnerability (DEFRA Magic Maps, 2018; classifications updated by the Environment Agency, 2018).

7.1.3.9 To protect groundwater quality and resources, the Environment Agency designates groundwater Source Protection Zones (SPZs) around potable water abstraction points. A drinking water safeguarding zone and associated SPZ is located within the southern section of the onshore scoping boundary, near Lockington and Beverley (DEFRA Magic Map, 2018).

Land Use and Ground Conditions

7.1.3.10 Land use within the onshore scoping boundary is predominantly rural in nature, with the exception of areas immediately west of Beverley and Leconfield (classified as 'non-agricultural' or 'urban'). There is the potential for rural land use to include potential contamination sources, or diffuse pollution from current agricultural activities. Nearer developed settlements, there is the potential for historic sources of contamination from past land use. Historic and more recent waste disposal in landfill sites have occurred in both rural and urban settings. Natural England classifies the majority of agricultural land in the study area as Grade 2 ('very good') or Grade 3 ('good' to 'moderate'). There is a small area of land near Skipsea that is classified as Grade 4 ('very poor').

7.1.3.11 Data provided by ERYC indicates areas of potential contaminated land within the onshore scoping boundary (see **Figure 7-2**). Potential areas of contamination are largely related to historic and current farming infrastructure and practices, potential infilled areas / landfill (of unknown fill material), historic works areas, Ministry of Defence land, sewage disposal as well as existing and historic (or disused) railway land. Potential contamination sources

within the study area will be further assessed during the PEIR upon review of environmental information including historical maps, location of known sources and pollution incidents.

7.1.3.12 Data provided by ERYC indicate there are several minerals safeguarding areas within the onshore scoping boundary, including at the landfall section, along the ECC and within the substation area, as shown in **Figure 7-2**.

Designated Sites

7.1.3.13 Geological designations within the Study area are detailed in **Table 7-2** and shown in **Figure 7-2**.

Table 7-2 Relevant Designations within the Geology and Ground Conditions Study Area

Site	Location	Description
Withow Gap, Skipsea SSSI	East of Skipsea	Important site for interpretation of Late Devensian (glacial) and Flandrain (post-glacial) environmental history in Holderness.
Skipsea Bail Mere SSSI	North west of Skipsea	Lake deposits underlying agricultural land provide vegetational history (from Late Devensian) of the northern part of the Holderness coastal plain

7.1.3.14 Three other SSSIs are partly within the 700 m ECC and are designated for biological reasons and therefore discussed in **section 7.3**.

7.1.4 Project Basis for Scoping Assessment

7.1.4.1 The geology and ground conditions scoping assessment is based on the following aspects of Hornsea Four.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.

- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.

- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.

- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.

- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.

- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.

- Soils and geology will only be exposed to impacts within the temporary construction and permanent infrastructure footprints (as set out above and described in Chapter 3), noting that the locations and extents of activities will be refined as route planning and site selection and design progress.

- The project does not involve the extensive processing, handling and storage of hazardous materials or require intrusive maintenance activity, therefore there is limited potential for effects on geology and soils during operation.

7.1.4.2 The assessment considers potential effects on geology, land and groundwater resources and related designated sites. The desk-based assessment is informed by consideration of the initial identification of potential contaminative sources, combined with the presence and nature of potential pathways and receptors (including human receptors, ecological receptors and natural resources such as groundwater and designated sites).

7.1.4.3 Inputs from other topics in regards to inter-related effects on human health, ecological receptors and the water environment are also considered.

7.1.4.4 The basis for the assessment also includes embedded mitigation where appropriate, which will influence the magnitude and / or the likelihood of an impact.

7.1.5 Embedded Mitigation

7.1.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on geology and ground conditions (see **Table 7-3**). As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of Hornsea Four and have, therefore, been considered in the assessment presented in **Section 7.1.6** (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measure will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

Table 7-3 Relevant Geology and Ground Conditions Commitments

Commitment ID	Measure Proposed	How the measure will be secured
Co1	Primary: All natural watercourses including main rivers and ordinary watercourses (not artificial drainage ditches, flood defences), main roads and railways will be crossed by HDD or other trenchless technology where technically feasible.	CoCP and DCO requirement
Co2	Primary: Where practical the following sensitive sites will be avoided by the permanent project footprint: SSSI Units (dependent upon condition), Ancient woodland, areas of consented development, areas of historic landfill and other known areas of potential contamination.	DCO Works Plans and Order limits
Co7	Tertiary: The construction working area will typically be 80m working width along the underground cable route to minimise the construction footprint.	DCO Works Plans and Order limits
Co10	Tertiary: Post-construction the working area will be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.	CoCP and DCO requirement
Co22	Tertiary: During both construction and operation, refuelling of machinery will be undertaken within designated areas where spillages can be easily contained. Machinery will be routinely checked to ensure it is in good working condition. Any tanks and associated pipe work containing oils and fuels will be double skinned and be provided with intermediate leak detection equipment. Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) will be bunded and carefully sited to minimise the risk of hazardous substances entering the drainage system or the local watercourses. Additionally, the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage. Bunds used will store fuel, oil etc. to have a 110% capacity. All plant machinery and vehicles will be maintained in a good condition to reduce the risk of fuel leaks.	CoCP and DCO requirement
Co25	Primary: The onshore cable route will be completely buried underground for its entire length (excepting those within the operational footprint).	DCO Works Plans, description of development and requirements
Co28	Primary: Joint Bays will be completely buried, with the land above reinstated excepting link box chambers where access will be required from ground level, e.g. via manholes.	DCO Works Plans, description of development and requirements
Co41	Primary: All trenchless crossings will be undertaken by non-impact methods and, as such, construction vibration would be unlikely to be significant beyond the immediate location of works. No blasting is anticipated.	CoCP and DCO requirement

Commitment ID	Measure Proposed	How the measure will be secured
Co64	Tertiary: During construction of the cable trenches the topsoil and subsoil will be stripped and stored on site within the temporary working corridor of the Hornsea Four onshore cable corridor. The topsoil and subsoil will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). No material will be stockpiled within the floodzone of any watercourse.	CoCP and DCO requirement
Co76	Tertiary: Potential risks to human health from any encountered (unexpected) ground contamination will be avoided by the use of appropriate Personal Protective Equipment (PPE) and by adopting appropriate working practices.	CoCP and DCO requirement
Co77	Tertiary: Any contamination encountered during the construction phase would be subject to appropriate risk assessment and if necessary, either removed, treated and/ or mitigated as part of the project.	CoCP and DCO requirement

7.1.6 Likely Significant Effects

7.1.6.1 Table 7-4 sets out an assessment of effects on geology and soils at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.1.6.2 The assessment presented in Table 7-4 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 7-3, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for geology and ground conditions effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in Section 1.7; and the professional judgement of qualified geologists and hydro-geologists.

7.1.6.3 Table 7-4 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.1.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 7-4 Likely Effects – Geology and Ground Conditions

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
Damage to the coastline and impacts on coastal erosion: Construction phase Trenchless techniques (i.e. HDD) will be used for the landfall construction	N/A	Negligible	Medium	**No likely significant effects.** The use of trenchless techniques will avoid effects on the integrity of the cliff including any changes in the current coastal erosion regime.	**Scoped out** Effects avoided, no further assessment required.	Baseline data will be reviewed to provide input to the engineering design, but this activity will not be assessed in the PEIR. Data sources include: • BGS data; • available site investigations; • online information on coastal mitigation in the area.
Damage to designated geological SSSIs: Construction phase Any ground breaking activities that directly overlap with them could affect geological designated SSSIs.	Primary: Co2	No change or Negligible	High	**No likely significant effects.** Whilst the scoping assessment has identified two SSSIs, these features will be avoided as part of the routeing.	**Scoped out** Effects avoided, no further assessment required.	N/A
Sterilisation of future mineral resources: Operational phase Where overlaps occur between the permanent ECC and regional geological sites and/or minerals safeguarding areas this could sterilise future resources.	Primary: Co2 Tertiary: Co7 Co10	Small, potentially medium	Medium/High	**Likely significant effects without secondary mitigation.** The RPSS exercise seeks to avoid regional geological sites and minerals safeguarding areas and has already avoided several, however in some cases	Scoped in Simple assessment approach will be adopted involving site walkover and baseline review. Consultation with ERYC to minimise impacts on the	Baseline data review to include identification of regional geological sites and planned minerals safeguarding areas. Data sources include: • BGS data • ERYC

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
				(at least the three areas which span the 700 m ECC) this may not be.	minerals safeguarding areas.	
Exposure of workforce to health impacts: Construction phase Construction activities (all project components), such as trenching, excavations and other earthworks could disturb contaminants where present, which could result in health risks to construction workers	Tertiary: Co76	Negligible	High	**No likely significant effects**. Pathway between receptor and source will be avoided through use of PPE.	**Scoped out** No further assessment required. Protective measures will be described in a CoCP.	N/A
Encountering contamination during intrusive works: Construction phase Construction activities (all project components), such as trenching, excavations and other earthworks could disturb contaminants, which could result in impacts on soil / land use; and pollution of groundwater.	Tertiary: Co77	Small, potentially medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** Areas of potential contamination exist, some of which will be avoided as the route planning and site selection proceed. However some may be unavoidable and a residual risk of encountering contamination will remain.	Scoped in A simple assessment approach will be adopted involving site walkover and baseline review of potential sources, pathways and receptors. This will feed into the development of a risk-based approach to managing potential contaminated soils during all aspects of construction.	Baseline data review to include identification of geology, hydrogeology and potential sources of contamination. Data sources to include: • BGS data • Envirocheck data • Local authority data • Available site investigation reports.

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
Soil compaction: Construction phase Construction vehicle movements and the creation of haul routes could cause compaction of the subsoil, which would degrade soil quality.	Tertiary: Co10 Co64	Negligible	Likely to range from low to high	**No likely significant effects**. Standard industry practices for the protection of top and subsoils during construction and their reinstatement post construction will avoid compaction impacts	**Scoped out** No further assessment required. Vulnerable soils and their locations will be described and protective and reinstatement measures will be described in a soils management plan or similar.	Baseline data review to include identification of different soil classes and their characteristics and vulnerability to compaction. Data sources to include: • BGS data • Envirocheck data • Local authority data • Available site investigation reports.
Dewatering of trenches and excavations: Construction phase If required, dewatering perched water or groundwater could reduce groundwater flow and affect water quality and base flow of local watercourses and abstractions.		Small	Likely to range from low to high	**Likely significant effects without secondary mitigation** At this stage the nature and value of the water resource is yet to be fully established.	Scoped in Simple assessment approach will be adopted involving survey, where necessary, and baseline review together with development of location-specific mitigation.	Baseline data review to include identification of hydrogeology. Data sources to include: • BGS data; • Envirocheck data; • Local authority data; • Available site investigation reports.
Physical intrusion into groundwater resource: Construction phase Installation of foundations, ground preparation and	Tertiary: Co77	Small, potentially medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** At this stage, the nature of the water resource is	Scoped in Simple assessment approach will be adopted involving baseline review of	Baseline data review to include identification of geology, hydrogeology and potential sources of

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
associated activities for the onshore substation could lead to potential contamination of underlying groundwater resources.				yet to be fully established in relation to where such works will occur	potential sources, pathways and receptors, but with embedded mitigation measures, assumed to be rated at most, a minor effect.	contamination. Data sources to include: • BGS data; • Envirocheck data; • Local authority data; • Available site investigation reports.
Accidental spills: Construction and Operation phase During both construction and operation, there exists the potential for accidental oil / fuel / hazardous substance spills from vehicles, contaminative equipment, storage containers / tanks and during maintenance operations (e.g. lubrication of electrical equipment). to contaminate the ground and groundwater, impacting the quality of local groundwater resources	Tertiary: Co22	Negligible	Likely to range from low to high	**No likely significant effects**. Whilst the scoping assessment has identified potential contaminative sources introduced by the construction and operation of Hornsea Four, embedded tertiary mitigation will be in place to avoid significant effects.	**Scoped out** No further assessment required. The CoCP will set out preventative measures and contingency plans.	N/A
Changes to current drainage and water infiltration to ground at the	Tertiary: Co22 Design in accordance with	Negligible	Likely to range from low to high	**No likely significant effects** SUDS design includes provision for	**Scoped out:** The Project Description will set out the SUDS design	Baseline data review to include estimate of current infiltration and greenfield run-off rates.

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
substation site: Operation phase Operational footprint of the onshore substation site could lead to a reduction in local groundwater infiltration rates, which would affect both quality and quantity of the resource.	widely accepted guidance on sustainable urban drainage systems (SUDS)			maintaining infiltration rates to ground and greenfield run=off rates.	principles for the substation	Data sources to include: • BGS data; • Envirocheck data; • Available site investigation reports; • Substation FRA.
Thermal impacts on groundwater: Operation phase Thermal effects of the underground power cables along the cable route corridor during operation could lead to potential impacts on groundwater quality and associated species / habitats. Reduction in WFD status.		Medium	Likely to range from low to high	**Likely significant effects without secondary mitigation**. At this stage the nature of the water resource is yet to be fully established.	Scoped in Simple assessment approach will be adopted involving baseline review of the groundwater units / existing water quality and future WFD status.	Baseline data review to include identification of geology, hydrogeology. Data sources to include: • BGS data; • Envirocheck data; and • Available site investigation reports.
Decommissioning The impacts during decommissioning will be similar, and potentially less than outlined for the construction phase for the substation. Based on leaving the underground cable in situ there will be no effects along the ECC.						

7.1.7 Impacts Scoped Out of the Assessment

7.1.7.1 The following sections detail the impacts that have been scoped out of the assessment, together with the basis for doing so.

Construction activities at the landfall section leading to potential increased rates of coastal erosion

7.1.7.2 The use of trenchless construction techniques (i.e. HDD) at the landfall section will significantly reduce the area of impact, and therefore reduce the potential magnitude of coastal erosion and impacts on the integrity of the cliff section to negligible. Moreover, embedded mitigation committed to reinstating conditions as far as reasonably practical following construction activities will further reduce the long-term impacts in the local area including maintaining the current rate of erosion in the area. The PEIR will describe the baseline features of the landfall section and detail further the mitigation measures to protect the area including allowing for the effect of future climate change over the operational lifetime of Hornsea Four.

Impact on geological-designated SSSIs

7.1.7.3 Nationally designated SSSIs (for geological reasons), were identified within the Hornsea Four area (see **Figure 7.1**and **Table 7-2**), specifically within the proposed landfall area. Whilst these SSSIs are located within the scoping boundary, embedded mitigation measures for Hornsea Four include the avoidance of such high valued areas and therefore no significant effects have been identified. Further route refinement during the PEIR will show Hornsea Four in relation to the SSSIs and demonstrate they have been avoided.

Construction workers exposure to contamination resulting in health risks

7.1.7.4 There is the potential that during construction-related activities, specifically groundworks including trenching and excavations, that construction workers could encounter unexpected or unknown sources of contamination. Such intrusive activities can create a pathway between the source (the contaminated material, soil or water in question) and the receptor (the construction worker), which may be in the form of dermal contact, inhalation or from digestion. Embedded mitigation measures incorporated within Hornsea Four, including adequate and correct use of PPE during these activities will create a necessary barrier between the source and receptor, and result in a 'negligible' impact. Furthermore, should unexpected contamination be encountered during construction of Hornsea Four; a thorough risk assessment will be conducted and appropriate measures taken to protect human health and the environment.

Soil Compaction due to Vehicle and Plant Movement during Construction

7.1.7.5 In areas subject to vehicle and heavy plant movement the topsoil and subsoil will be stripped and stored on site within the temporary working corridor. The topsoil and subsoil

will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.

7.1.7.6 Post-construction these working areas will be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.

7.1.7.7 Taking into consideration that the majority of the ECC is subject to agricultural activity including ploughing and other heavy machinery movements the potential for compaction effects with tertiary mitigation in place is minimal.

During construction and operation, potential contamination of the ground and groundwater from accidental leaks and spillages

7.1.7.8 During both the construction and operation phase, potential leaks and spills may occur from a number of project scenarios including from refuelling machinery / vehicles, from tanks and pipe work, which contain oils / fuels, and from hazardous substance stores (containing fuels, oils and chemicals). In the event of a spill or leak, this would affect local ground conditions and potentially groundwater quality underlying the area. However, embedded mitigation measures will significantly reduce potential impacts by following specific prevention and containment measures as follows.

- Refuelling of machinery will be undertaken within designated areas where spillages can be easily contained.
- Machinery will be routinely checked to ensure it is in good working condition.
- Any tanks and associated pipe work containing oils and fuels will be double skinned and provided with intermediate leak detection equipment.
- Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores will be bunded and carefully sited to minimise the risk of hazardous substances entering the drainage system or the local watercourses.
- The bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage.
- Bunds will be designed to have a 110% capacity.
- Construction materials will be managed in such a way as to effectively minimise the risk posed to the aquatic environment.
- All plant machinery and vehicles will be maintained in a good condition to reduce the risk of fuel leaks.

7.1.7.9 Consultation with the Environment Agency will be ongoing prior to and throughout the construction period to promote best practice and to implement these proposed mitigation measures.

Changes to current drainage and water infiltration to ground at the substation site: operational phase

7.1.7.10 The substation's surface water management and drainage system will be designed in accordance with SUDS guidance as widely adopted in industry. Current greenfield runoff and infiltration rates will be maintained by design.

7.1.8 Proposed Approach to the PEIR and ES

7.1.8.1 The PEIR will include a simple assessment of the potential geology and ground conditions effects. This will include a detailed review of site-specific data from an environmental database (i.e. Landmark Envirocheck report) and a targeted walkover of areas of interest (e.g. the landfall) if the desk-based review indicates this is necessary. No detailed assessment, (e.g. intrusive ground investigations) is proposed. A CSM will be established which will compare this with the baseline environment, as well as with the identified activities during the construction, operation or the decommissioning phase of Hornsea Four.

7.1.8.2 The CSM will adopt the risk management process as outlined in the model procedures for the management of land contamination (Contaminated Land Report 11 (CLR 11)) (DEFRA / EA, 2004). This is based on the source-pathway-receptor approach (i.e. 'pollutant linkages') to identify potential sources of contamination, human and environmental receptors, and the different pathways that connect the source to the receptor. In this instance, the source may be a potentially polluting activity from Hornsea Four or other current external activities, or from existing ground contamination.

7.1.8.3 The assessment will consider potential effects on geology, land and groundwater resources and related designated sites as proposed in **Table 7-4**. Significant effects during the construction, operation or decommissioning of Hornsea Four will be assessed using standard impact assessment methods and criteria such as those detailed in **Annex C**, which will be refined for the PEIR.

7.1.8.4 Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts. The requirement of additional measures will be dependent on the significance of the effects of geology and ground conditions and will be consulted upon with statutory organisations during the EIA process. The significance of residual effects remaining after implementation of proposed secondary mitigation measures will be presented and potential cumulative effects will be considered as appropriate.

7.1.8.5 Consultation with ERYC, the Environment Agency and other relevant statutory and non-statutory organisations will be undertaken as necessary throughout the process.

7.1.9 Scoping Questions for Consultees

7.1.9.1 ERYC, the Environment Agency and other relevant consultees in relation to geology and ground conditions are asked to consider the following questions:

1. Is there any other baseline information that should be considered, including regional geological areas of importance?
2. Can ERYC or EA advise on any specific sources of contamination of concern to them within the ECC, substation and landfall areas?
3. Have all relevant potential impacts on geology, hydrogeology and ground conditions been identified that might arise from Hornsea Four activities?
4. Do you agree with the geology, hydrogeology and ground conditions impacts that have been scoped in and out of the assessment, together with the reasons for doing so?
5. Do you agree with the proposed baseline data sources and collection methods during the PEIR?
6. Do you agree with the methodology presented within the scoping report in regards to future assessment for the PEIR?
7. Are the embedded mitigation measures relevant to geology and ground conditions sufficient to avoid the more significant impacts identified?

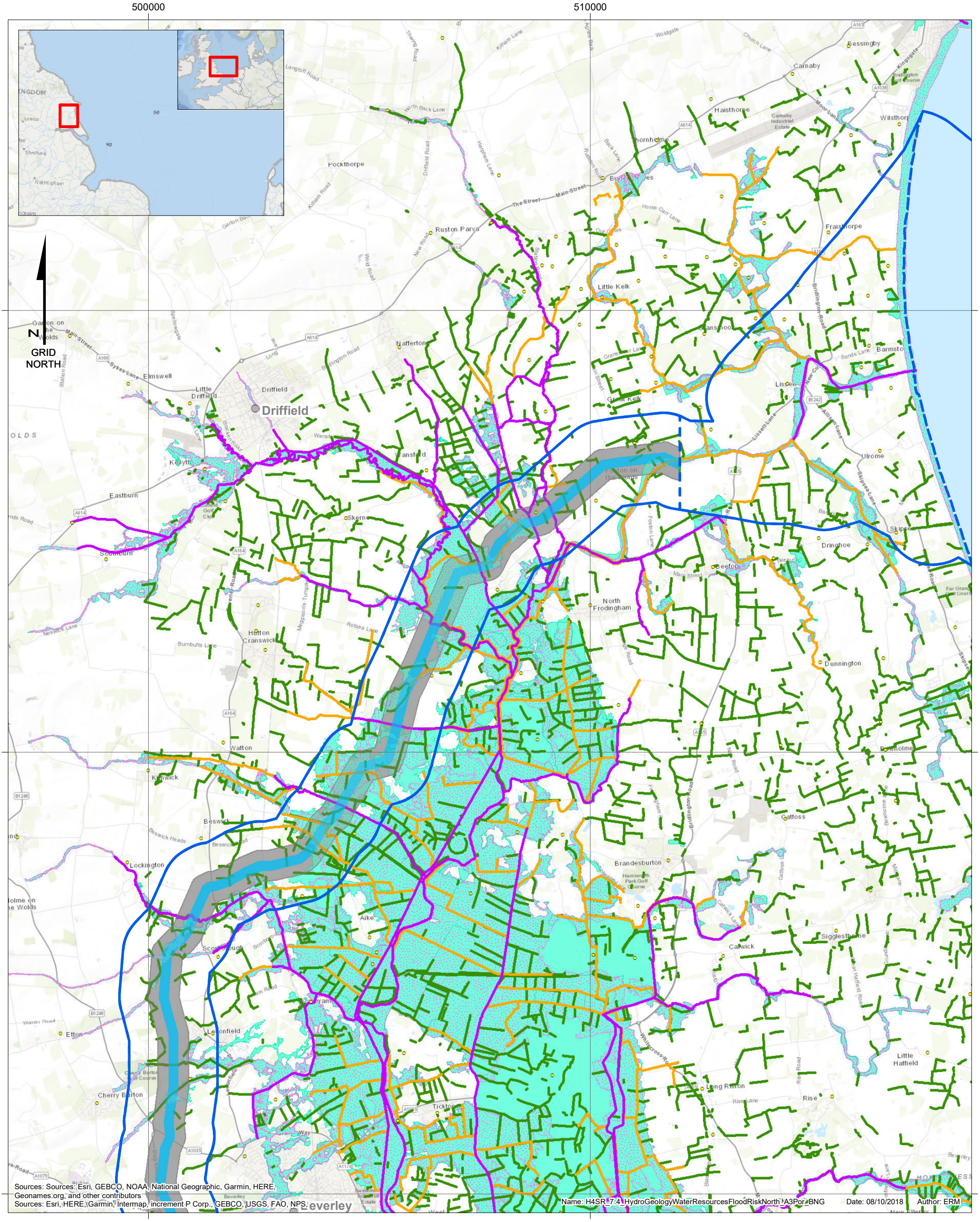
7.2 Hydrology and Flood Risk

7.2.1 Introduction

7.2.1.1 This section of the Scoping Report identifies the onshore water resources and flood risk interests of relevance to Hornsea Four and considers the potential effects from construction, operation and maintenance and decommissioning activities of the onshore components (i.e. landward of MHWS) of Hornsea Four.

7.2.2 Study Area

7.2.2.1 The general study area for water resources and flood risk incorporates all watercourses that have the potential to be crossed or otherwise directly affected by the construction of the onshore ECC and substation, based on the alignment of the 200 m indicative permanent cable area within the 2 km wide onshore scoping boundary as shown in **Figure 7-4** and **Figure 7-5**. Water resource considerations seaward of MHWS are addressed in **Chapter 6** Environmental Topics and Potential Effects Offshore. It should be noted that the study area will be reviewed and amended in response to the refinement of the landfall, onshore ECC and onshore substation areas and the identification of any additional potential water resources and flood risk receptors.



- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works

Settlements

- Town
- Village

- Main Rivers (Environment Agency)
- Internal Drainage Board Drains (Beverley and North Holderness)
- Surface Water (Ordnance Survey)
- Fluvial Flood Zone 2 (Environment Agency)
- Fluvial Flood Zone 3 (Environment Agency)

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:80000

0 0.5 1 1.5 2 Kilometres

0 0.5 1 1.5 2 Miles

Hornsea Four

Water Resources and Flood Risk Study Area (North)

Figure: 7.4

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Checked by: SR
Approved by: NL

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Sources: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Name: H4SR_7.5_HydroGeologyWaterResourcesFloodRiskSouth_A3Por_BNG Date: 08/10/2018 Author: ERM

- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works

Settlements

- Town
- Village

- Main Rivers (Environment Agency)
- Internal Drainage Board Drains (Beverley and North Holderness)
- Surface Water (Ordnance Survey)
- Fluvial Flood Zone 2 (Environment Agency)
- Fluvial Flood Zone 3 (Environment Agency)

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:45000

0 0.25 0.5 0.75 1 Kilometre
0 0.25 0.5 0.75 1 Mile

Hornsea Four

Water Resources and Flood Risk Study Area (South)

Figure: 7.5

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Checked by: SR
Approved by: NL

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7.2.3 Baseline Environment

7.2.3.1 An initial desk based review of the study area has been undertaken to establish the number and type of watercourses that may be crossed in the development of Hornsea Four, and to establish areas of potential fluvial and surface water flood risk. Consideration of the potential impacts on other water resources, such as surface water abstractions and discharges are also considered. The following sources of information in Table 7-5 were consulted.

Table 7-5 Key Sources of Hydrology and Flood Risk Data

Source	Summary	Coverage of Hornsea Four development area
Environment Agency	Environment Agency were consulted for: - Mapped surface watercourses. - Main Rivers, IDB Drains, OS Surface Water Line. - Agency Flood Zones of Planning. - Surface Water Flood Risk Maps. - Hull and Coastal Streams Catchment Flood Management Plan. - Humber River Basin District River Basin Management Plan	Full coverage of the Hornsea Four onshore scoping boundary.
Aerial photography		Full coverage of the Hornsea Four onshore scoping boundary.
DEFRA	Humber River Basin District River Basin Management Plan	Full coverage of the Hornsea Four onshore scoping boundary.
Yorkshire Water	Water Resources Management Plan	Full coverage of the Hornsea Four onshore scoping boundary.
East Riding of Yorkshire Council	Local Flood Risk Management Strategy	Full coverage of the Hornsea Four onshore scoping boundary.
ERYC	East Riding Integrated Coastal Zone Management Plan	Full coverage of the Hornsea Four onshore scoping boundary.
Humber Estuary Coastal Authorities Group.	Flamborough Head to Gibraltar Point Shoreline Management Plan	Full coverage of the Hornsea Four onshore scoping boundary.

7.2.3.2 The route of the onshore ECC spans a length of approximately 38 km from the landfall site on the North Sea coast to the onshore substation search area. A watercourse crossing schedule has been prepared during the scoping process, to assist in the identification and classification of all watercourses along the route of the onshore ECC. Along this length, the onshore project components have the potential to cross a total of 54 watercourses. Based on the available map data, 26 of these watercourses are Main Rivers or watercourses which are maintained by Beverley and North Holderness IDB, and will thus serve a significant flood control / land drainage function. The remainder appear to be minor

drainage ditches. Further details of these watercourses are presented in the watercourse crossing schedule presented in **Annex G**.

7.2.3.3 In addition to the crossing of watercourses, the route also passes across 9.9 km of mapped Environment Agency fluvial flood zones, and seven formal flood defences.

7.2.4 Project Basis for Scoping Assessment

Overview

7.2.4.1 The water resources and flood risk scoping assessment is based on the following parameters and assumptions.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.

- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.

- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.

- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.

- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.

- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.

- All temporary and permanent project footprints will be located within the 700 m indicative temporary works area, the 200 m indicative permanent cable area, the substation search area and the landfall search area (noting that the locations and

extents of activities will be refined as route planning and site selection and design progress) and no construction activities will be undertaken outside these areas.

- All land disturbed during the construction of the landfall and cable route will be restored to its pre-construction condition, with no long term change in topography that could have an effect on surface water flow or available flood plain storage volumes.

- The cables will be essentially maintenance free, however, should maintenance be required this will be undertaken following standard protocols and best practice to ensure the risk of potential spillage of pollutants (e.g. oils, hydraulics fluids etc.) can be avoided.

- The onshore substation will be located within Flood Zone 1 on a site >1 ha. A flood risk assessment will be undertaken and high-level drainage strategy prepared as part of the DCO application.

7.2.4.2 As such, the EIA will only be required to consider the potential impacts on water resources and flood risk that will arise during the construction/installation of the export cables. Two activities that have the potential to affect the water environment have been identified during construction, these are: construction of permanent cable watercourse crossings; and temporary vehicle watercourse crossings. If not appropriately mitigated, the impacts that may arise as a result of these activities are:

- a temporary increase in runoff from new hardstanding areas / impermeable surfaces;
- temporary displacement of flood water due to storage of materials in flood prone areas;
- creation of new flood flow routes along the excavated cable trench(s) if left open for prolonged periods;
- reductions in water quality within watercourses crossed by the onshore components of the project due to release of chemicals / fuels / sediments etc.; and
- temporary reduction in ground water availability to private water supplies due to drawdown / dewatering of the cable trench prior to back filling.

7.2.4.3 Based on the above assumptions, it is considered that it will be possible for all of the above potential construction impacts to be mitigated through embedded measures (**Table 7-6**) and the development of an appropriately detailed CoCP / CEMP. The following process has been undertaken to enable future discussions with the appropriate authorities / statutory consultees to agree construction methodologies and embedded mitigation.

- A draft watercourse crossing schedule has been developed using the following methodology:
  - identify all watercourse crossings using the Environment Agency digital river network GIS data, Route alignment and haul road alignment; and
  - categorise watercourses using available map, aerial photograph, WFD status, and flood zone data.

- The watercourses crossing schedule presents details of all of the watercourses to be crossed, the type of watercourse (watercourse category), and proposed crossing methodology (HDD, open cut).
- Propose appropriate crossing methodologies for each crossing and agree with appropriate statutory consultees (EA / IDB).
- At the scoping stage, the watercourse crossing schedule only includes details of the onshore ECC, as the design of Hornsea Four is progressed, the schedule will be extended to include vehicle access crossings if and where necessary. This further detail will be provided in the PEIR.

7.2.4.4 Once the watercourse crossing schedule has been developed, the construction surface water and drainage management plan and watercourse crossing method statements can be developed and incorporated into the draft CoCP, which will form an appendix to the Development Consent Order (DCO) and the requirement to follow the CoCP will be written as a condition of the Order.

7.2.4.5 At the scoping stage, the project has made a commitment that all main rivers, and watercourses that are maintained by the Beverley and North Holderness IDB will be crossed using trenchless techniques.

Onshore Substation

7.2.4.6 With regards to the onshore substation it is possible that this element of Hornsea Four may have long-term, operational impacts on flood risk. As the substation is likely to be sited within Flood Zone 1, the risks from fluvial (river) flooding is anticipated to be negligible. As such, it is presently anticipated that the main risk to be addressed will be the potential for an increase in surface water runoff from areas of hardstanding which could increase flood risk to other areas if unmitigated.

7.2.4.7 Given the probable size of the proposed substation (>1ha), it will be a requirement that a flood risk assessment is produced and submitted as part of the DCO application. As the substation is anticipated to be sited within Flood Zone 1, the risks from fluvial (river) flooding will be considered negligible, and therefore the main risk to be addressed will be associated with any potential increase in surface water runoff from areas of hardstanding, which may have the potential to increase surface water flooding to areas off-site.

7.2.4.8 It is not anticipated that a detailed Sustainable Drainage Systems (SuDS) / drainage design will be developed for submission with the DCO, however it is proposed that the FRA could provide a high level drainage strategy. This would investigate the potential increase in surface water runoff volume and seek to demonstrate that there is sufficient land available within the order limits to provide sufficient attenuation to agreed, greenfield runoff rates. This approach will be progressed subject to agreement with the EA and LLFA.

7.2.5 Embedded Mitigation

7.2.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on water resources and flood risk (see Table 7-6). These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in Annex A.

7.2.5.2 As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in section 7.2.6 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 7-6 Relevant Water Resources and Flood Risk Commitments

Commitment ID	Measure Proposed	How the Measure will be Secured
Co1	Primary: All natural watercourses including main rivers and ordinary watercourses (not artificial drainage ditches, flood defences), main roads and railways will be crossed by HDD or other trenchless technology where technically practical.	CoCP and DCO requirement
Co10	Tertiary: Post-construction the working area will be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.	CoCP and DCO requirement
Co25	Primary: The onshore cable route will be completely buried underground for its entire length (excepting those components within the operational footprint).	DCO Works Plans, description of development and requirements
Co34	Primary: Where HDD technologies are not required or practical, the crossing of drainage ditches or engineered channels may be undertaken by open cut methods and / or the installation of temporary culverts or bridges to allow water to continue flowing. This will be in line with advice notes, guidance documents and additional information including Environment Agency Pollution Prevention Guidelines (PPGs) will be adhered to, particularly: • PPG01 General Guide to the Prevention of Water Pollution; • PPG02 Above Ground Oil Storage Tanks; • PPG04 Disposal of Sewage where no Mains Drainage is Available; • PPG05: Works in, Near or Liable to Affect Watercourses; • PPG06: Working at Construction and Demolition Sites; • PPG08 Safe Storage and Disposal of Used Oils; • PPG21: Pollution Incident Response Planning; and • Pollution Prevention: Major Pipeline.	CoCP and DCO requirement

Co64	Tertiary: During construction of the cable trenches the topsoil and subsoil will be stripped and stored on site within the temporary working corridor of the Hornsea Four onshore cable corridor. The topsoil and subsoil will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). No material will be stockpiled within the flood zone of any watercourse.	CoCP and DCO requirement
Co80	Primary: A crossing schedule will be provided which includes crossing methodology for each crossing of road, rail, PRoW and watercourse.	CoCP and DCO requirement

7.2.6 Likely Significant Effects

7.2.6.1 **Table 7-7** sets out an assessment of effects on hydrology and flood risk at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in **Annex A**) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.2.6.2 The assessment presented in **Table 7-7** is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in **Table 7-6**, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for hydrology and flood risk effects; relevant policy; the assessment criteria provided in **Annex C**; the question-led approach set out in **Section 1.7**; and the professional judgement of qualified hydrologists.

7.2.6.3 **Table 7-7** is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.2.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 7-7 Likely Effects – Water Resources and Flood Risk

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipatedl mportance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple of Detailed)	Further Baseline Data Requirements
Coastal erosion at the landfall: Construction phase Works associated with crossing the landfall by HDD may lead to increased rates of coastal erosion and associated flood risk from the sea.	Primary Co1 Tertiary Co10	No Change	High	**No likely significant effects.**	**Scoped out**	N/A
Disturbance of watercourses: Construction phase Works associated with cable crossings Main Rivers and IDB maintained watercourses may result in a reduction in water quality and channel hydro-morphology.	Primary Co1 Co80	No Change	High	**No likely significant effects.**	**Scoped out**	Development of the water course crossing schedule and agreement of crossing methodology with EA, IDB and LLFA.
Access across watercourses: Construction phase Works associated with access track crossings of Main Rivers and IDB maintained watercourses may result in a reduction in water quality and channel hydro-morphology.	Access routes will be designed to avoid high value watercourses. Where avoidance is not possible, baily bridges, or other crossing structures may be required on a temporary basis.	Small	High	**Negligible / Minor – No likely significant effects.** Any structures that are required to be constructed across watercourses will be subject to appropriate permits from the EA / LLFA.	Scoped in A simple assessment approach will be adopted involving an assessment of the likely physical impacts on the channel banks, and riparian vegetation.	Development of the water course crossing schedule and agreement of crossing methodology with EA, IDB and LLFA.

Disturbance of minor drainage ditches: Construction phase Works associated with cable crossings of minor drainage ditches (as defined in the watercourses crossing schedule and agreed with EA, IDB and LLFA) may result in a reduction in water quality and channel hydro-morphology.	Primary Co34 Co80	Small	Low – Medium	**No likely significant effects.**	**Scoped out**	Development of the water course crossing schedule and agreement of crossing methodology with EA and other stakeholders
Access across minor drainage ditches: Construction phase Works associated with access track crossings of minor drainage ditches (as defined in the watercourses crossing schedule and to be agreed with EA, IDB and LLFA) may result in a reduction in water quality and channel hydro-morphology.	Access routes will be designed to avoid watercourses where possible. Where avoidance is not possible, baily bridges, or other crossing structures may be required on a temporary basis.	Small	Low – Medium	**No likely significant effects.**	**Scoped out**	Development of the water course crossing schedule and agreement of crossing methodology with EA and other stakeholders
Disruption of local land drainage: Construction phase Works associated with cable installation leading to impacts on the integrity of the local land drainage systems and potential flooding.	Primary Co25 Tertiary Co10 Co64	Negligible	Likely to range from low to high	**No likely significant effects.**	**Scoped out**	N/A
Changes in water quality: Construction phase Works associated with cable installation leading to impacts on	Primary Co25 Co34	Negligible	Likely to range from low to high	**No likely significant effects.**	**Scoped out**	N/A

the water quality of watercourses and drainage systems local to the works.	Tertiary Co64					
Alteration in run-off characteristics at substation site: Operation phase The operational presence of the substation may alter surface run-off characteristics from the site and could lead to increased flood risk elsewhere.		Small to Medium	Low to Very High	**Likely significant effect without secondary mitigation** Increase in flood risk from surface water has the potential to affect the substation itself, and increase flood risk to sensitive receptors downstream which could have a significant effect if not mitigated.	Scoped in A simple assessment will be undertaken to inform the formal Flood Risk Assessment. This will include details of the proposed drainage strategy that will show how surface water will be attenuated within the order limits.	Design and layout of proposed substation, including areas of hardstanding and permeability. Calculations of baseline and new run-off rates. Development of indicative drainage strategy.
Mobilisation of pollutants in the event of disturbance of contaminated soils: Construction phase Works associated with construction of the cable and substation may mobilise contaminants into surface water run-off from the site.	Primary Co25 Co34 Tertiary Co64	Negligible	High	**No likely significant effects.**	**Scoped out**	N/A
Decommissioning phase Works associated with decommissioning of the cable	Buried cables will be de-energised with the ends sealed and left in place to avoid ground disturbance.	Negligible	High	**No likely significant effects.**	**Scoped out**	N/A
Decommissioning phase	Decommissioning practices will incorporate	Negligible	High	**No likely significant effects.**	**Scoped out**	N/A

Works associated with decommissioning of substation	measures to prevent pollution, to include emergency spill response procedures, and clean up and remediation of contaminated soils. The measures will follow a similar approach to those set out for the construction phase.					

7.2.7 Impacts Scoped out of Assessment

HDD crossing of landfall (Construction, Operation and Decommissioning)

7.2.7.1 At the landfall area, by virtue of the height of the coastal cliffs and onshore land elevations, the risk of flooding from the sea is low. However, the use of open cut techniques across the cliffs could cause the cliffs to be destabilised, and result in an acceleration of the rate of erosion along this coastal frontage. By committing to constructing the landfall using trenchless techniques, Hornsea Four ensures that there will be no physical excavations of the cliff toe, face, or top, which could destabilise the cliff and result in erosion.

7.2.7.2 Since the use of trenchless techniques at the landfall area ensure no interaction with the cliff, the magnitude of change to this receptor can reasonably be assessed as 'No Change'. As such, it is predicted that the magnitude and vulnerability score for the impact would be negligible, therefore this impact is scoped out of assessment.

7.2.7.3 This approach is consistent with the assessment outcomes of the Hornsea Project Three EIA (Chapter 2 – Hydrology and Flood Risk Environmental Statement).

Cable crossings of Main Rivers and IDB maintained watercourses (Construction, Operation and Decommissioning)

7.2.7.4 All major watercourses will be crossed using HDD techniques. The impacts on major watercourses from construction activities involving the use of HDD techniques are considered negligible. On account of the nature of the technique, the method ensures that there is no interaction between the works, and the watercourse to be crossed, and as such no potential pathway for an impact is created.

7.2.7.5 Since the use of trenchless techniques at the landfall area ensure no interaction with the cliff, the magnitude of change to this receptor can only be assessed as 'No Change'. As such, it is predicted that the magnitude and vulnerability score for the impact would be negligible, therefore this impact is scoped out of assessment.

7.2.7.6 This approach is consistent with the assessment outcomes of the Hornsea Project Three EIA (Chapter 2 – Hydrology and Flood Risk Environmental Statement).

Works associated with cable crossings of minor drainage ditches

7.2.7.7 A number of minor watercourses and drains may be crossed by the Hornsea Four onshore cable corridor. The associated construction could lead to damage to the banks along the watercourses, an increase in turbid runoff, spillages/leaks of fuel, oil etc. and an alteration in surface water flow pathways that could affect nearby watercourses.

7.2.7.8 An outline method statement for crossing watercourses and other mitigation measures to reduce and manage runoff in terms of volume and quality will be presented in the Outline

CoCP and will be developed further in discussion with the EA, IDB and LLFA. These measures would include the use of settling tanks or ponds to remove sediment. At the end of the construction programme measures would be implemented to ensure that watercourses, including their banks, are reinstated to their previous condition as far as is reasonably practicable.

7.2.7.9 The impact of these works is predicted to be of local spatial extent, short term duration, intermittent occurrence and high reversibility. The magnitude is therefore, considered to be negligible, and therefore this impact is scoped out of assessment.

7.2.7.10 This approach is consistent with the assessment outcomes of the Hornsea Project Three EIA (Chapter 2 – Hydrology and Flood Risk Environmental Statement).

Works associated with access track crossings of minor drainage ditches

7.2.7.11 A number of minor watercourses and drains will need to be crossed by the Hornsea Four access track(s). The associated construction could lead to damage to the banks along the watercourses, an increase in turbid runoff, spillages/leaks of fuel, oil etc. and an alteration in surface water flow pathways that could affect nearby watercourses and effect flood risk.

7.2.7.12 An outline method statement for crossing watercourses and other mitigation measures to reduce and manage runoff in terms of volume and quality will be presented in the outline CoCP and will be developed further in discussion with the EA, IDB and LLFA. These measures would include the use of settling tanks or ponds to remove sediment and the installation of pre-installed culvert (flume) pipes in the watercourse under the construction accesses and haul road. The pipe would be of suitable size to accommodate the water volumes and flows, or temporary bridging may be installed to ensure no change in the conveyance capacity of the channel. The accesses and haul roads would be removed at the end of the construction programme and measures would be implemented to ensure that watercourses, including their banks, are reinstated to their previous condition as far as is reasonably practicable.

7.2.7.13 The impact of these works is predicted to be of local spatial extent, short term duration, intermittent occurrence and high reversibility. The magnitude is therefore, considered to be negligible, and therefore this impact is scoped out of assessment.

7.2.7.14 This approach is consistent with the assessment outcomes of the Hornsea Project Three EIA (Chapter 2 – Hydrology and Flood Risk Environmental Statement).

Works associated with cable installation leading to impacts on the integrity of the local land drainage systems and potential flooding.

7.2.7.15 The impact on field drainage and irrigation from open cut techniques and the installation of link boxes and jointing bays during the construction phase could temporarily affect surface water flow pathways, impacting on water quality and potential flow rates.

7.2.7.16 The removal / severance of field drains along the length of the cable trench may cause a backup on surrounding field drains, in turn increasing the flood risk to surrounding sensitive receptors. Measures to manage surface water flows include the restoration of field drainage following the installation of the Hornsea Four onshore cable corridor, and techniques to manage surface water runoff along the corridor will be incorporated into the draft CoCP.

7.2.7.17 With the incorporation of appropriate construction mitigation techniques and Drainage Management Plan the impact is predicted to be of local spatial extent with a minor shift away from existing hydrological environment of local receptors, short term duration, intermittent occurrence and reversible with field drains to be re-established where appropriate. It is predicted that any impact will affect the receptor directly. The magnitude is therefore, considered to be minor.

7.2.7.18 This approach is consistent with the assessment outcomes of the Hornsea Project Three EIA (Chapter 2 – Hydrology and Flood Risk Environmental Statement).

Works associated with cable installation leading to impacts on the water quality of watercourses and drainage systems local to the works, and works associated with construction of the cable and substation may mobilise contaminants into surface water run-off from the site.

7.2.7.19 Potential impacts associated with pollution from mobilised suspended solids (sediment) is generally considered the greatest risk to water quality, along with spillages/leaks of fuel, oil etc, where oils, chemicals and cement are to be used in the vicinity of open water. Suspended sediment due to runoff from stripped construction areas and excavations can have a negative impact on water quality, this is particularly true in sloping areas with underlying clay following topsoil stripping as well as areas of moderate to high rainfall.

7.2.7.20 A method statement for controlling pollution will be presented in the Outline CoCP and will be developed further in discussion with the EA, IDB and LLFA. These measures would include the use of settling tanks or ponds to remove sediment.

7.2.7.21 The impact of these works is predicted to be of local spatial extent, short term duration, intermittent occurrence and high reversibility. The magnitude is therefore, considered to be negligible, and therefore this impact is scoped out of assessment.

Works Associated with Decommissioning of the Cable

7.2.7.22 The decommissioning of the onshore EEC will involve de-energising the electrical cables, with the ends sealed. The cables will then be left in place to avoid any potential impacts that could arise as a result of the ground disturbance that would result if the cables were to be recovered. The cables themselves are to be manufactured from inert materials that will not deteriorate overtime, and as such will not pose a future pollution risk. All decommissioning activities will be detailed in a decommissioning plan will be developed prior to decommissioning to ensure that all works are carried out following the best practice guidance in place at the time of decommissioning.

7.2.7.23 As such, it is predicted that the magnitude and vulnerability score for the impacts from the decommissioning of the cables would be negligible, therefore this impact is scoped out of assessment.

Works Associated with Decommissioning of the Substation

7.2.7.24 The decommissioning of the onshore sub-station will involve the demolition of buildings as well as removal of foundations and surface water management system provided during construction and operation. It is anticipated that the natural attenuation of the sites will be restored over time.

7.2.7.25 The impacts of decommissioning of the Hornsea Four components will be reduced through the incorporation of management measures, including emergency spill response procedures including clean up and remediation of contaminated soils, appropriate water proofing of exposed cable ducts and the continued maintenance of on-site drainage and therefore are predicted to be of local spatial extent, short term duration, intermittent and high reversibility indicating that any impacts on decommissioning which affect flood risk vulnerability and water quality are likely to only affect the surrounding local receptors.

7.2.7.26 The impact of these works is predicted to be of local spatial extent, short term duration, intermittent occurrence and high reversibility. The magnitude is therefore, considered to be negligible, and therefore this impact is scoped out of assessment.

7.2.8 Proposed Approach to the PEIR and ES

7.2.8.1 Once the area required for the onshore ECC has been refined, site-specific data concerning water abstractions and discharges will be reviewed from an environmental database (i.e. Landmark Envirocheck report). Further work will also be undertaken to develop the crossing schedule to incorporate channel cross sections to help further classify the channels and agree appropriate crossing methodologies with the Environment Agency, Beverley and North Holderness IDB, and East Riding of Yorkshire Council (in their role as Lead Local Flood Authority). This will form part of the CoCP (as described above) A targeted walkover of areas of interest will be undertaken following further review of the

information, if necessary to classify and agree crossing methodologies and to contribute to the Flood Risk Assessment.

7.2.8.2 The PEIR will include a simple assessment of the potential flood risk effects from construction of the substation. This will include production of a formal Flood Risk Assessment, with calculations of baseline and new run-off rates, and evidence of how surface water will be attenuated within the Order limits. An indicative drainage strategy will be prepared.

7.2.8.3 It is considered that all other potential impacts on surface water and flood risk can be mitigated by embedded mitigation measures (**Table 7-7**), such as the CoCP and decommissioning plan, and it is proposed that these be scoped out from further assessment.

7.2.8.4 The significance of flood risk effects will be determined using standard impact assessment methods and criteria such as those advised by the Design Manual for Roads and Bridges (DMRB) as shown in **Annex C**. The assessment will take into account the magnitude (intensity, duration, extent) of the impact and the sensitivity of affected receptors to a particular impact.

7.2.8.5 Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts and suitable opportunities to enhance the nature conservation interest of the site will also be developed. The significance of residual effects remaining after implementation of proposed mitigation measures will be presented and the assessment will include consideration of potential cumulative effects as appropriate.

7.2.8.6 Consultation will be held with relevant statutory and non-statutory organisations throughout the EIA process.

7.2.9 Scoping Questions for Consultees

7.2.9.1 Scoping questions for the EA, IDB and ERYC in relation to water resources and flood risk include:

1. Do you agree that the crossing of watercourses of various types without causing any significant effects on their hydrology, quality or ecology can be achieved through well-established standard industry practices of known efficacy?
2. Do you agree that a Water Framework Directive Compliance Assessment will not be necessary if the PEIR presents sufficient evidence to demonstrate that Hornsea Four will not result in any significant effects on surface watercourses?
3. Do you agree that it is sufficient to demonstrate that any additional surface water within the substation footprint can be attenuated within in the Order Limits, rather than producing a detailed surface water drainage system design?
4. Do you agree that committing to trenchless crossings of Main Rivers and IDB maintained watercourses is sufficient to conclude that the construction of the onshore ECC will not result in significant affects?

5. Do you agree that open trench crossings of minor ditches, following industry best practice construction methods for such crossings, will be sufficient to ensure such crossings would not result in significant affects?
6. Do the Lead Local Flood Authority (LLFA) own, operate, or maintain any flood defences that are not included in the EA Spatial Flood Defences (including standardised attributes) data set, which may be crossed by the onshore ECC? If the answer is yes, please can data be provided?
7. Are there any other 3rd party flood defences along the route of the onshore ECC that the Applicant should be aware of?

7.3 Ecology and Nature Conservation

7.3.1 Introduction

7.3.1.1 This section of the Scoping Report identifies the onshore ecology (biodiversity) and nature conservation interests of relevance to Hornsea Four and considers the potential effects from construction, operation and maintenance and decommissioning activities of the onshore components (i.e. landward of MHWS) of Hornsea Four. The nature of Hornsea Four is such that the majority of effects on ecology will occur during the construction phase

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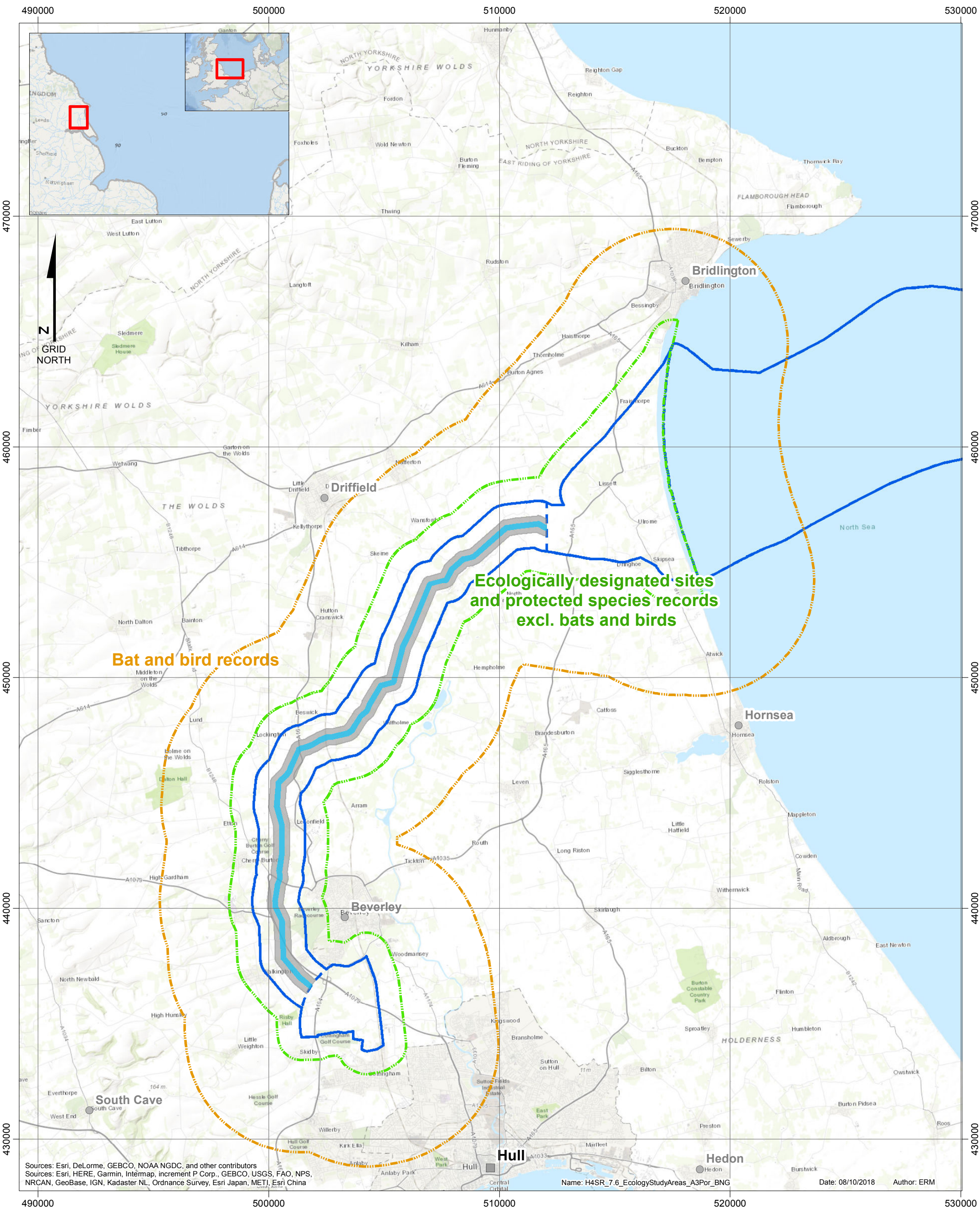
7.3.2 Study Area

7.3.2.1 At this stage, the study area (illustrated in **Figure 7-6**) is defined as land within the scoping boundary landward of MHWS and including the intertidal zone. The study area will be reviewed and amended in response to such matters as refinement of the onshore project components and the identification of additional impact pathways and in response to feedback from consultation. Ecology and nature conservation seaward of MHWS and including the intertidal zone is addressed in **chapters 7.2 Benthic Ecology**, **7.3 Fish and Shellfish Ecology** and **7.4 Marine Mammals**.

7.3.2.2 A 2 km buffer around the landfall area, indicative onshore cable route and onshore substation search area was used for the data search (illustrated in **Figure 7-6**). The data search included ecologically designated sites and records of protected species. This data search area was increased to 5 km for bat and bird data to take into account the greater mobility of these species. A 2km buffer was chosen to also allow for potential variation in final location and alignments and to identify any existing features including ponds or woodland that might affect or be affected by the onshore elements of Hornsea Four. The data search areas also aligns with the approach taken for onshore elements of previous Hornsea projects. A dedicated data search for Natura 2000 sites is addressed in the Hornsea Four Offshore Wind Farm Habitat Regulation Assessment Screening Report (HOW04 HRA Screening Report (00228544_A).



- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works

Settlements

- City
- Town
- 2km Data Search Area
- 5km Data Search Area

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:150000

0 1 2 3 4 Kilometres

0 1 2 3 4 Miles

Hornsea Four

Onshore Ecology and Nature Conservation Desk Study Area

Figure: 7.6

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Checked by: JP
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7.3.3 Baseline Environment

7.3.3.1 Data Sources used for Scoping

7.3.3.2 Data on international, national and local designated sites have been obtained to support the Scoping Report. The following sources of information in Table 7-8 were consulted.

Table 7-8 Key Sources of Ecology and Nature Conservation Data

Source	Summary	Coverage of Hornsea Four Development Area
Humber Nature Partnership	Review of habitats and species on the coastal plain estuary including intertidal mudflats and sandflats, saltmarshes, lagoons and sand dunes.	A 1 km buffer around the Hornsea Four onshore scoping boundary
Yorkshire Wildlife Trust	Review of wildlife	A 1 km buffer around the Hornsea Four onshore scoping boundary.
British Wildlife Trust	Review of wildlife data	A 1 km buffer around the Hornsea Four onshore scoping boundary.
RSPB		A 1 km buffer around the Hornsea Four onshore scoping boundary.
Buglife		A 1 km buffer around the Hornsea Four onshore scoping boundary.
Botanical Society		A 1 km buffer around the Hornsea Four onshore scoping boundary.
Environment Agency		A 1 km buffer around the Hornsea Four onshore scoping boundary.
East Yorkshire Bat Group	Review of data collected on bat roosts, habitat, feeding areas ad hibernation sites.	A 5 km buffer around the Hornsea Four onshore scoping boundary.
East Yorkshire Ecological Data Centre (NEYEDC)	Details of Sites of Nature Conservation Importance, Local Wildlife Sites and BAP Habitats.	A 1 km buffer around the Hornsea Four onshore scoping boundary.
JNCC	Details of Sites of Nature Conservation Importance, Local Wildlife Sites and BAP Habitats.	A 1 km buffer around the Hornsea Four onshore scoping boundary.

Source	Summary	Coverage of Hornsea Four Development Area
Natural England	Site notifications and further details of SACs, SPAs, pSACs, pSPAs, Ramsar Sites, SSSIs, NNRs and Ancient Woodland. Details of Sites of Nature Conservation Importance, Local Wildlife Sites and BAP Habitats.	A 1 km buffer around the Hornsea Four onshore scoping boundary.
East Yorkshire Badger Protection Group (EYBPG)	Review of badgers and setts in East Yorkshire.	A 1 km buffer around the Hornsea Four onshore scoping boundary.
Yorkshire Amphibian and Reptile Group	Review of amphibian and reptile abundance	A 1 km buffer around the Hornsea Four onshore scoping boundary.
Wolds Barn Owl Study Group.	Review of owl species and abundance	A 1 km buffer around the Hornsea Four onshore scoping boundary.

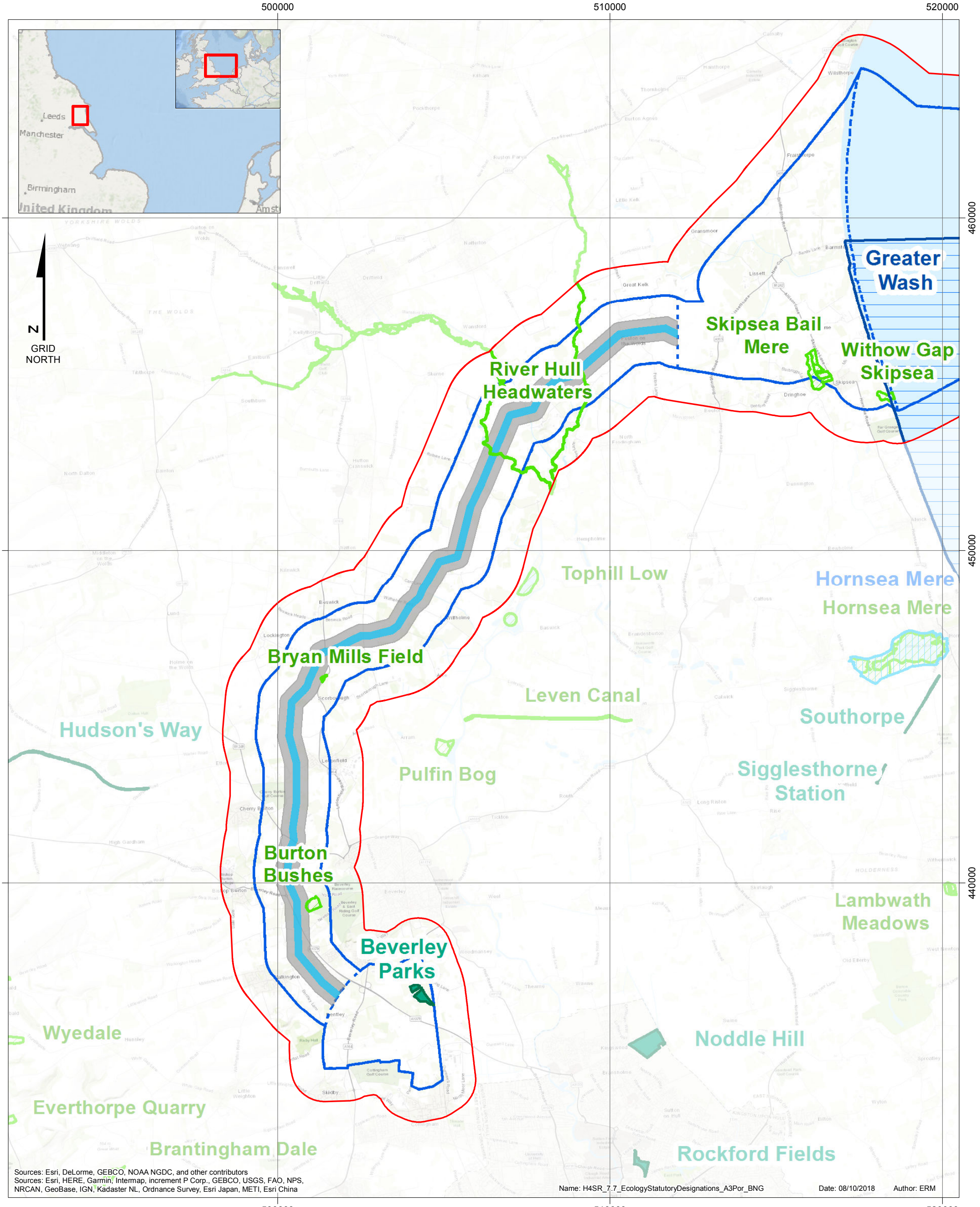
7.3.3.3 Relevant publications, including previous site survey reports for projects in the local area were reviewed to aid identification of key habitats and species.

7.3.3.4 An extended Phase 1 habitat survey was completed in August 2018 to identify existing habitats. The Phase 1 habitat survey was based on a desktop review of high quality 3 cm resolution aerial photography supported by ground-truthing using an adaptation of the standard Phase 1 Habitat methodology as extended for use in Environmental Assessment. The extended phase 1 habitat survey covered all land within the 700 m indicative temporary works area, including the landfall area and the land within the proposed onshore substation search area. During the ground-truthing any habitats and plant species of importance and signs of protected species identified were recorded.

7.3.3.5 The Phase 1 habitat mapping is included in **Annex H**. It is worth noting that the aerial photography was acquired for an area 1 km either side of the indicative centreline of the onshore ECC. Therefore, in the event that further route planning and site selection work requires onshore components to be outside of the 700 m surveyed area, additional Phase 1 mapping, and where necessary ground-truthing, will be undertaken to advise the design process and understand the effects of varied alignments and siting.

Designated Sites

7.3.3.6 **Figure 7-7** presents the statutory ecological designations within 1 km of the onshore scoping boundary and **Figure 7-8** presents non-statutory designations within 1 km of the onshore scoping boundary. Both figures also illustrate those known features that are located within the 700 m indicative temporary works area.



- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works
- 2km Data Search
- Special Protection Area (Natural England)
- Potential Special Protection Area (Natural England)
- Site of Special Scientific Interest Areas (Natural England)
- Local Nature Reserve (Natural England)

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

Statutory Nature Conservation Designations

Figure: 7.7

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Checked by: JP
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460000 450000 440000

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GRID NORTH

Key	LWS Site
1	Old Howe House
2	Beverley Limekilns
3	Scorborough Lane
4	Gembling Common
5	Lambfold Wood
6	Shorthill Hag
7	Swadgery Mere Wood
8	Copper Hall Wood
9	Cranswick Common
10	Mill Beck and Fields
11	Gravel Pit, North Frodingham
12	Risby Park
13	Fishpond Wood, Risby Estate
14	Mill Dam Beswick
15	Moor Lane
16	Newbald Road
17	Woodhill Path, Cottingham
18	Driffield Road
19	Old Lane, Leconfield
20	Skipsea Brough
21	Easingwold Farm
22	Bygot Wood Lane, Leconfield
23	Corpslanding Road
24	Sheepman Lane
25	Bealey's Lane
26	Leman Wood
27	Leman Road Corner - Moorbeck Road (a)
28	Leman Road Corner - Moorbeck Road (b)
29	Lake's Wood
30	Bentley Moor Wood
31	Birkhill Wood
32	Drove Road
33	Raventhorpe Embankment
34	Barff Hill Causeway
35	Bryan Mills Beck
36	Bealey's Beck, Lockington
37	Emmotland Soak Drain
38	Foston Fox Covert Heronry
39	Beverley Westwood Waxcaps
40	Jillywood Lane
41	Hamilton Hill, Barmston
42	Wilsthorpe Dunes
43	Lockington
44	Burton Bushes Veteran Trees
45	Newbald Road, Beverley
46	Keldmarsh
47	Snakeholm Pastures
48	Skerne Wetlands

Sources: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Name: H4SR_7.8_EcologyNonStatutoryDesignations_A3Por_BNG Date: 08/10/2018 Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works
- 2km Data Search Area

Local Wildlife Sites (Non Statutory Areas)

- Candidate Local Wildlife Site
- Designated Local Wildlife Site

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

Non-statutory Nature Conservation Designations

Figure: 7.8

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Habitats

7.3.3.8 The habitat within the study area is predominantly agricultural, dominated by large open arable fields with mostly species poor hedgerows. There are some areas of scattered woodland, grassland and scrub and a network of rivers, streams, drains and ponds. The common and widespread habitat within the study area is representative of the region's vast agricultural landscape.

7.3.3.9 Based on the findings from the extended Phase 1 habitat assessment and desk study records received to date, the only detailed habitat surveys proposed are hedgerow surveys.

Protected Species

7.3.3.10 Based on the suitability of the habitats recorded from the extended Phase 1 habitat assessment (See **Annex H**) and records received to date that highlight the presence of the following protected species within the study area, the following surveys are proposed:

- bat;
- breeding birds;
- wintering birds;
- otter;
- water vole;
- great crested newt;
- reptiles; and
- badger.

7.3.3.11 The Phase 2 surveys that are required will be undertaken using best practice methodologies by suitably experienced and trained ecologists.

7.3.4 Project Basis for Scoping Assessment

7.3.4.1 The ecology and nature conservation scoping assessment is based on the following assumptions.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.

- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide.

Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.

- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.

- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.

- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.

- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.

- The temporary and permanent project footprint will be within the substation search area, the landfall search area and the 700 m indicative temporary works area and 200 m indicative permanent cable area of the ECC respectively, noting that the locations and extents of activities will be refined as route planning and site selection and design progress.
- Habitats will be lost within construction compounds for the duration of the construction period but reinstated afterwards as closely as practicable to their original condition.

- Long-term loss of all habitats is assumed for above ground operational components i.e. the onshore substation and energy balancing facility.

7.3.4.2 The basis for assessment also includes the embedded mitigation where appropriate, as set out below in **section 7.3.6**.

7.3.5 Embedded Mitigation

7.3.5.1 As part of the design process, several designed-in measures have been proposed to reduce the potential for impacts on ecology.**Error! Reference source not found.** These will evolve o ver the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register, which is presented in full in **Annex A**.

7.3.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of

Hornsea Four and have, therefore, been considered in the assessment presented in Section 7.3.5 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 7-9 Relevant Ecology and Nature Conservation Commitments

ID	Measure Proposed	How the measure will be secured
Co1	Primary: All natural watercourses including main rivers and ordinary watercourses (not artificial drainage ditches, flood defences), main roads and railways will be crossed by HDD or other trenchless technology where technically practical.	CoCP and DCO requirement
Co2	Primary - Where practical the following sensitive sites will be avoided by the permanent project footprint: SSSI Units, Ancient woodland, areas of consented development, areas of historic landfill and other known areas of potential contamination, RSPB reserves, Local Nature Reserves, Local Wildlife Sites, Yorkshire Wildlife Trust Sites, National Trust Land, Listing Buildings and Scheduled Monuments. Where possible, unprotected areas of woodland, mature and protected trees (those with Tree Preservation Orders TPOs) shall also be avoided.	DCO Works Plans and Order limits
Co7	Primary: The construction working area will typically be 80 m working width along the underground cable route to minimise the construction footprint. Other crossings may expand this default to greater than 80 m (HDD and local factors, over small lengths). The permanent width will be 6 0m.	DCO Works Plans and Order limits
Co25	Primary: The onshore cable route will be completely buried underground for its entire length	DCO Works Plans, description of development and requirements
Co26	Primary: Hedgerows and vegetation will be retained where possible. Where it is not possible to retain, hedgerows will be removed prior to topsoil removal, the width of hedge and vegetation removed will be limited where practical.	DCO Works Plans and CoCP
Co34	Primary: Where HDD technologies are not required or practical, the crossing of drainage ditches may be undertaken by open cut methods and / or the installation of temporary culverts or bridges to allow water to continue flowing. This will be in line with advice notes, guidance documents and additional information including Environment Agency Pollution Prevention Guidelines (PPGs) will be adhered to, particularly: • PPG01 General Guide to the Prevention of Water Pollution; • PPG02 Above Ground Oil Storage Tanks; • PPG04 Disposal of Sewage where no Mains Drainage is Available; • PPG05: Works in, Near or Liable to Affect Watercourses; • PPG06: Working at Construction and Demolition Sites; • PPG08 Safe Storage and Disposal of Used Oils; • PPG21: Pollution Incident Response Planning; and • Pollution Prevention: Major Pipeline.	CoCP and DCO requirement

ID	Measure Proposed	How the measure will be secured
Co36	Primary: Core working hours for the construction of the onshore elements of Hornsea Four will be as follows: • Monday to Friday: 07:00 - 18:00 hours; • Saturday: 07:00 - 13:00 hours; • Up to one hour before and after core working hours for mobilisation ("mobilisation period"), i.e. 06:00 to 19:00 weekdays and 06:00 to 14:00 Saturdays; and • Maintenance period 13:00 to 17:00 Saturdays. Activities carried out during mobilisation and maintenance will not generate significant noise levels (such as piling, or other such noisy activities).	CoCP and DCO requirement
Co78 / Co118	Primary: Micro-siting will be undertaken during detailed design to avoid all ponds if practical.	DCO Works Plans
Co114	Tertiary: Best practice air quality management measures will be applied as described in Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction 2014, version 1.1, where relevant and practicable to the activities being undertaken.	CoCP and DCO requirement
Co123	Tertiary: Based on noise modelling results, where noise has the potential to cause disturbance the use of mufflers, acoustic barriers and directional lighting for areas where HDD is undertaken.	DCO requirement

7.3.6 Likely Significant Effects

7.3.6.1 Table 7-10 sets out an assessment of effects on ecology and nature conservation at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.3.6.2 The assessment presented in Table 7-10 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 7-9, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for ecology effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in Section 1.7; and the professional judgement of qualified ecologists.

7.3.6.3 Table 7-10 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.3.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 7-10 Likely Effects – Ecology and Nature Conservation

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Direct impacts on designated sites: **Construction phase** Temporary construction areas could occupy areas leading to loss and/or degradation of designated sites.	Primary Co1 Co2 Co7 Co26 Tertiary Co114	None	Low to high	**Not significant** due to the commitment to avoid them as part of the RPSS based on the 700 m indicative temporary works area as shown in Figure 7-6. See section 7.3.8.	**Scoped out**	N/A
Impacts on non-designated sites: **Construction phase** Construction compounds, access roads and other infrastructure will temporarily occupy areas leading to loss and/or degradation of non-designated habitat.	Primary Co1 Co2 Co7 Co26 Tertiary Co114	Medium	Range from low to high	**Likely significant effect without secondary mitigation** Habitats could be temporarily lost, damaged or degraded as a result of construction activities.	Scoped in A simple assessment approach will be adopted which will include identification of features via Phase 1 Habitat survey results to feed into location-specific restoration and reinstatement measures.	N/A Phase 1 Habitat survey complete Standard hedgerow survey techniques in accordance with Natural England requirements of representative habitat affected by Hornsea Four.
Impacts on bat species: **Construction phase** Construction activities will temporarily occupy areas leading to loss and / or degradation of habitat and loss of habitat connectivity used by bats for roosting, commuting and / or foraging.	Primary Co2 Co26 Co36 Tertiary Co123	Range from small to medium	Range from low to high	**Likely significant effect without secondary mitigation** Bat roosts and bat commuting and / or foraging habitat could be temporarily lost, damaged or degraded as a result of construction activities. Roosting, commuting and	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of confirmed bat roosts and any key commuting and / or foraging areas used by bats. The maps will be annotated in terms of	Standard bat survey techniques in accordance with Natural England requirements of areas of habitat with moderate or high potential for bat roosts and / or commuting and / foraging habitat.

				foraging bats could be disturbed by light, vibration and other activities associated with construction.	commitments to standard (secondary) mitigation (e.g. use of directional lighting during night work).	
Impacts on breeding and / or wintering bird species: **Construction phase** Construction activities will temporarily occupy areas leading to loss and / or degradation of habitat and loss of habitat connectivity used by breeding and / or wintering birds.	Primary Co2 Co7 Co26	Range from small to medium	Range from low to high	**Likely significant effect without secondary mitigation** Breeding and wintering bird habitat could be temporarily lost, damaged, severed/ fragmented or disturbed as a result of construction activities. Nesting birds could be disturbed by increases in personnel on site, noise, vibration and other activities associated with construction.	Scoped in A simple assessment approach will be adopted involving surveys of breeding and wintering birds. Maps will be produced and annotated in terms of commitments to standard (secondary) mitigation (e.g. Having an ECoW on site to check vegetation for breeding birds prior to its removal).	Standard breeding bird and wintering bird survey techniques in accordance with Natural England requirements covering areas of representative habitat affected by the onshore Hornsea Four project components.
Impacts on otter and / or water vole: **Construction phase** Open cut trenching and HDD used to cross watercourses with otter and / or water vole potential could lead to loss of habitat, disturbance and / or connectivity severance.	Primary Co1 Co34 Tertiary Co123	*Otter* Range from small to medium *Water vole* Range from small to large	High	**Likely significant effect without secondary mitigation** Open-cut cable installation methods could temporarily remove, damage or degrade otter and / or water vole habitat. Open-cut trenching and HDD will increase noise, vibration, light and personnel presence associated with construction	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of watercourses with otter and / or water vole present. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. setting out the location and extent of any habitat manipulation to temporarily displace individual animals).	Standard otter and water vole survey techniques in accordance with Natural England requirements of the watercourses that will be directly affected by Hornsea Four.

				and could disturb or temporarily displace individual animals.		
Impacts on great crested newt populations: **Construction phase** Works in or within 250 m of water bodies with great crested newt potential could cause habitat loss, degradation, habitat severance and harm or kill individual animals.	Primary Co2 Co7 Co26 Co78/118	Range from small to large	High	**Likely significant effect without secondary mitigation** Great crested newts (GCN) habitat (ponds and terrestrial) could be temporarily lost, damaged or severed/fragmented as a result of construction activities. Individuals could be harmed or killed during construction activities.	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of water bodies with great crested newt present. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. location of new ponds).	Standard GCN survey techniques in accordance with Natural England requirements of the project footprint plus 250 m.
Impacts on white-clawed crayfish and fish: **Construction phase** Open cut trenching, used to cross watercourses could lead to loss of habitat, disturbance and / or connectivity severance on white-clawed crayfish and fish.	Primary Co1 Co34 Tertiary Co123	Range from small to large	Range from low to high	**Not significant** See **Section 7.3.8.**	**Scoped out**	
Impacts on reptiles: **Construction phase** Construction activities will temporarily occupy areas	Primary Co2 Co7 Co26	Small	Low	**Potentially significant without secondary mitigation.**	Scoped in A simple assessment approach will be adopted involving survey,	Standard reptile survey techniques in accordance with Natural England requirements of representative suitable

leading to loss and / or degradation of habitat, loss of habitat connectivity and harm or mortality of individual reptiles.				Reptile habitat could be temporarily lost, damaged or severed/fragmented as a result of construction activities. Individuals could be harmed or killed during construction activities.	identification and mapping of areas with confirmed reptile presence. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. working under a method statement).	habitat affected by Hornsea Four.
Impacts on badgers: **Construction phase** Construction activities could disturb badger setts and / or lead to temporary severance of territories.	Primary Co2 Co7 Co26 Co36 Tertiary Co123 .	Small	Low	**Likely significant effect without secondary mitigation.** Construction will increase noise, vibration, light and personnel presence and could disturb badger setts. Badger habitat could be temporarily lost, damaged or territories severed/fragmented as a result of construction activities.	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of badger setts. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. provision of replacement sett).	Standard badger survey techniques in accordance with Natural England requirements of representative suitable habitat affected by Hornsea Four.
Impacts on habitats or species: **Construction phase** Construction could cause damage to habitats or species from accidental release of pollutants	Tertiary Co114	Negligible	Range from low to high	**Not significant** See **Section 7.3.8**.	**Scoped out**	N/A
Impacts on habitats or species: **Operation phase** Operation of the onshore substation will cause long-term habitat loss,		Low	Range from low to high	**Potentially significant without secondary mitigation.** The onshore substation will reduce the area of habitat for the duration of its operation	Scoped in Simple assessment approach will be adopted involving survey, identification and mapping of	Phase 1 habitat assessment complete Standard Phase 2 protected species surveys in accordance with Natural England

degradation and potential displacement of protected species					habitat and areas with confirmed protected species presence.	requirements in the onshore substation location plus a 250 m buffer.
Impacts on habitats: **Operation phase** Excavating a section of cable for maintenance or repair could cause temporary habitat loss or degradation		Low	Range from low to high	**Not significant** As discussed and agreed in principle with Natural England September 2018. See **section 7.3.8.**	**Scoped out**	N/A
Impacts on protected species: **Operation phase** Operation and maintenance activities of the onshore cable route could cause disturbance to protected species		Low	Range from low to high	**Not significant** As discussed and agreed in principle with Natural England September 2018. See **7.3.7.1**	**Scoped out**	N/A
Impacts on protected species: **Operation phase** Operation and maintenance activities of the onshore substation could cause disturbance to protected species		Low	Range from low to high	**Likely significant effect without secondary mitigation** Depending on the onshore substation's final location, increases in noise and light emissions could disturb protected species e.g. bats in ancient woodland.	<u>Scoped in</u> Simple assessment approach will be adopted involving survey, identification and mapping of habitat and areas with confirmed protected species presence including mitigation such as the use of minimal directional lighting.	Phase 1 habitat assessment complete Standard Phase 2 protected species surveys in accordance with Natural England requirements in the onshore substation location plus a 250 m buffer.
Impacts on habitats or species: **Operation phase** Operation and maintenance activities could cause damage		Negligible	Range from low to high	**Not significant** See **Section 7.3.7.1**	**Scoped out**	N/A

to habitats or species from accidental release of pollutants						
Impacts on habitats: Decommissioning phase Decommissioning of onshore cable could cause temporary loss or degradation to habitat		Not affected	Low to high	**Not significant** See **Section 7.3.7.1**	**Scoped out**	N/A
Impacts on habitats: Decommissioning phase Decommissioning of the onshore substation could lead to temporary habitat loss or degradation		N/A	Low to high	**Likely significant effect without secondary mitigation.** The decommissioning of the onshore substation will likely require land in addition to the substation's operational footprint temporarily in order to decommission the substation which could lead to habitat loss or degradation.	Scoped in Simple assessment approach will be adopted involving survey, identification and mapping of habitat within a 250 m buffer of the onshore substation	Phase 1 habitat assessment complete Standard Phase 2 protected species surveys in accordance with Natural England requirements in the onshore substation location plus a 250 m buffer.
Impacts on protected species: Decommissioning phase Decommissioning of the onshore substation could lead to temporary disturbance or displacement of protected species		Low	Low to high	**Likely significant effect without secondary mitigation.** The decommissioning of the onshore substation will likely require an additional area to the substation's operational footprint in order to decommission the substation that could lead to temporary habitat loss and disturbance or	Scoped in Simple assessment approach will be adopted involving survey, identification and mapping of habitat and areas with confirmed protected species presence within a 250 m buffer of the onshore substation	Phase 1 habitat survey complete

				displacement of protected species.		
Impacts on habitats or species: **Decommissioning phase** Decommissioning of the onshore substation could lead to damage to habitats or species from accidental release of pollutants		Low	Low to high	**Not significant** See **Section 7.3.8**	**Scoped out**	N/A

7.3.7 Impacts Scoped out of Assessment

7.3.7.1 Construction impacts have been scoped out of further assessment on white clawed crayfish, fish and on designated sites. Data from NEYEDC has confirmed that there are no records of white clawed crayfish in the study area over the past 50 years. It is assumed that primary mitigation measures identified (CO1, C34 and CO123 as set out in **Table 7-9**) will prevent significant effects on fish species.

7.3.7.2 Significant effects are not anticipated to designated sites due to the commitment made at the RPSS stage to avoid them (CO2 as set out in **Table 7-9**).

7.3.7.3 Operational impacts are not anticipated to be significant to habitats and species along the route of the export cable as it is buried for its entire length. From industry experience, the risk of onshore cable malfunction leading to cable excavation is negligible.

7.3.7.4 Significant effects are not anticipated to habitats and species from decommissioning activities along the route of the export cable as it will remain in situ and will not be excavated.

7.3.7.5 The Institute of Air Quality Management Guidance on the Assessment of Mineral Dust Impacts for Planning (May 2016 v1.1) notes that even close to well-managed mineral extraction sites in the UK, impacts from release of dust on habitats, if they occur at all, are rare. If effects are rare close to large-scale, long-term mineral extraction sites then impacts from smaller-scale, well-managed temporary construction, operation and decommissioning activity can be concluded to be negligible. Measures will be developed in a CoCP to manage dust emissions at construction stage and EMMP for operation and decommissioning.

7.3.7.6 Taking into account construction, operation and decommission techniques, the risk of runoff pollutants being released into the environment and causing damage to habitats is considered negligible. The CoCP and EMMP will include measures to be adopted for the prevention of pollution events and outline an emergency plan to be implemented in the unlikely event of any pollution events. Given how unlikely a pollution event is, in conjunction with a CoCP and EMMP, it is not expected that there will be a significant risk of runoff pollutant release during any phase of Hornsea Four.

7.3.8 Proposed Approach to the PEIR and ES

7.3.8.1 The assessment will consider potential effects on designated sites, habitats and species of nature conservation interest. The assessment will be informed by a combination of desk-based data search and field based surveys as shown in **Table 7-8**.

7.3.8.2 Proposed phase 2 surveys are set out in **Section 7.3.4** and these are provisionally programmed to take place during the optimum season, commencing with wintering birds in November 2018.

7.3.8.3 Consultation will be held with relevant statutory and non-statutory organisations as necessary and as part of the Evidence Plan process which as set out in **Section 5.6.5**. The assessment will continue to interact with and inform the RPSS process.

7.3.8.4 The assessment will take into account the magnitude of the impact and the sensitivity of affected receptors to a particular impact (as indicated in **Table 7-10** and applying the criteria set out in **Annex C**). This will include consideration of habitat extent or species population size at a given geographical level, habitat or population fragility (including ability to recover), the rarity of the species or habitat and susceptibility to environmental change.

7.3.8.5 Likely effects will be described and the assessment will include consideration of potential cumulative effects as appropriate.

7.3.8.6 Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts and suitable opportunities to enhance the nature conservation interest of the site will also be developed. The significance of residual effects remaining after implementation of proposed mitigation measures will be presented.

7.3.9 Scoping Questions for Consultees

7.3.9.1 Scoping questions for Natural England, ERYC and YWT in relation to ecology and nature conservation include:

1. Do you agree that all the designated sites within the search area have been identified?
2. Do you agree that all relevant sources of secondary data have been accessed for scoping or identified for use in the EIA?
3. Do you agree with the detailed surveys that have been scoped in?
4. Are there any other issues that should be considered based on the locality and previous experience with onshore cable routes?

7.4 Landscape and Visual Assessment

7.4.1 Introduction

7.4.1.1 This section of the Scoping Report identifies the onshore landscape and visual interests of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and, where relevant, decommissioning activities (i.e. landward of MHWS) of Hornsea Four.

7.4.1.2 Significant effects are likely to arise as a result of both the construction and operation of the onshore substation which will be visible as a new feature in the landscape during long term operation. The potential for likely significant effects arising from the onshore cabling is largely limited to the construction phase, since it will be buried.

7.4.2 Study Area

7.4.2.1 The LVIA study area will extend to a 2 km radius from the onshore ECC and landfall search area and 5 km from the onshore substation search area. Beyond these distances it is unlikely that there will be any notable visibility of Hornsea Four during construction or operation. It is judged that significant landscape or visual effects will be unlikely beyond this study area. The LVIA study area is illustrated in **Figure 7-9**.

7.4.2.2 The LVIA will also consider landscape and visual effects on areas of land from which the offshore booster station and offshore wind turbines may be visible. However, given their proposed distances from the nearest shore (see **Chapter 3** where distances are described), it is likely that these effects can be scoped out (see **Section 7.4.7**).

7.4.2.3 The study area will be reviewed and amended in response to such matters as: refinement of the onshore ECC; the location of a potential offshore HVAC booster; and the identification of additional impact pathways (e.g. cumulative effects).

7.4.2.4 Seascape and visual interests seaward of MHWS are addressed in **Section 6.11 Seascape and Visual Resources**.

7.4.3 Baseline Environment

Data Sources used for Scoping

7.4.3.1 A desk study was undertaken to obtain recent information on landscape and visual interests within the site and immediate surroundings. Sources of information on the landscape character and visual amenity of the area were reviewed. These data sources are described in **Table 7-11**.

Table 7-11 - Key Sources of Landscape and Visual Data

Source	Summary	Coverage of Hornsea Four Development Area
Ordnance Survey	Ordnance Survey mapping, indicating the locations of potential visual receptors including settlements, residential properties, National trails, Public Rights of Way (PRoW), and tourist and recreational sites.	2 km radius from the onshore ECC and 5 km from the onshore substation.
Aerial photography	Aerial photography indicating the locations of potential visual receptors including settlements and residential properties.	2 km radius from the onshore ECC and 5 km from the onshore substation.
Natural England	National Landscape Character Area profiles (NLCA) published online, 2014. National level landscape	2 km radius from the onshore ECC and 5 km from the onshore substation.

Source	Summary	Coverage of Hornsea Four Development Area
	designations, designated by Natural England (National Parks and Area of Outstanding Natural Beauty – neither are present in the study area)	
ERYC	East Riding of Yorkshire Landscape Character Assessment, and the Landscape Character Types (LCT) it describes, 2005. Local level landscape designations, designated by ERYC, including Important Landscape Areas (ILA)	2 km radius from the onshore ECC and 5 km from the onshore substation.
Zone of Theoretical Visibility	Computer generated indicative Zone of Theoretical Visibility (ZTV) maps for the proposed onshore substation.	2 km radius from the onshore ECC and 5 km from the onshore substation.

7.4.3.2 Previous landscape and visual impact assessments for projects proposed in the local area were also consulted to aid identification of landscape and visual receptors.

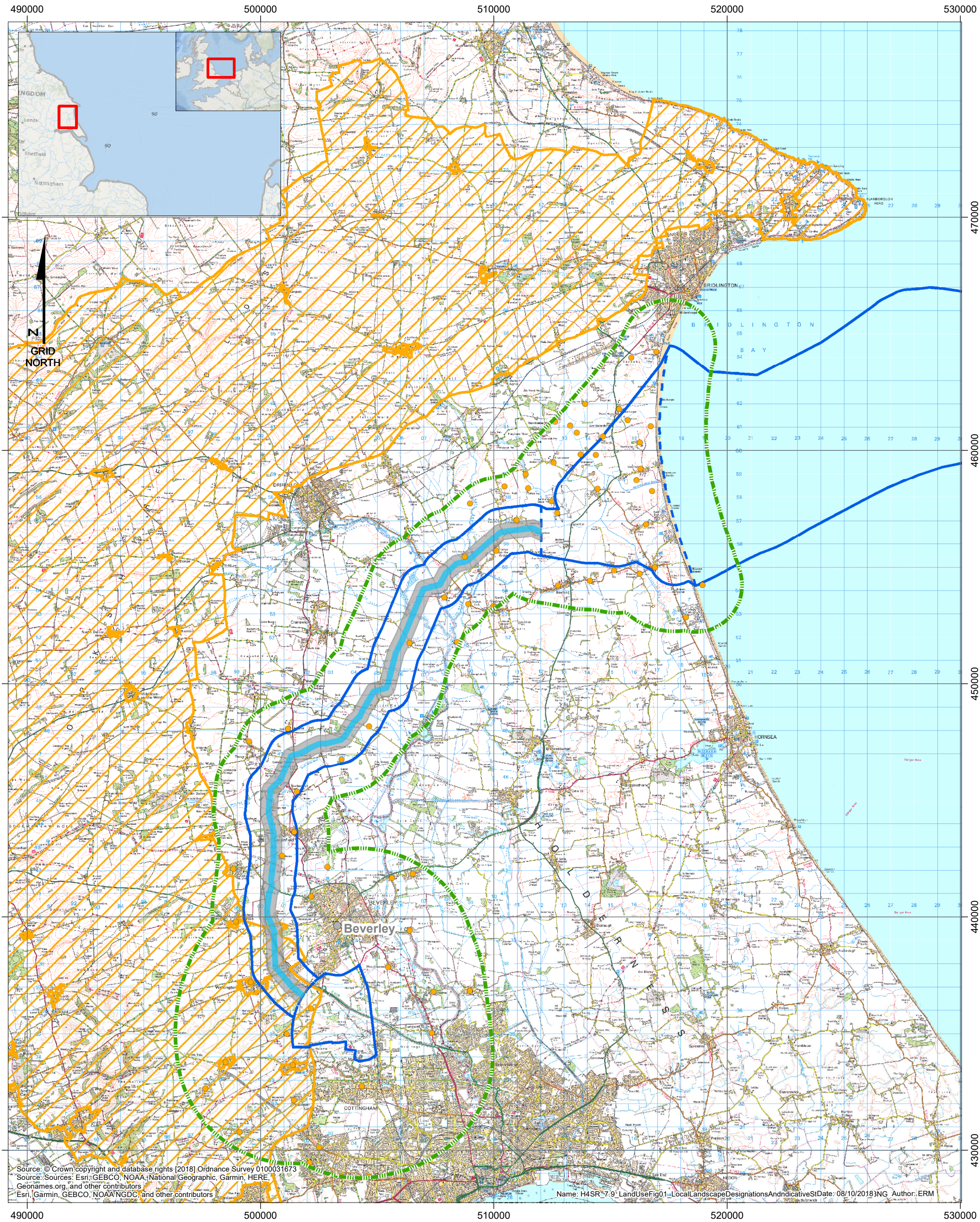
7.4.3.3 A field survey was undertaken of the proposed onshore substation search area on the 19th July 2018 by a Chartered Landscape Architect. Observations were made from roads and PRoW to inform an appraisal of the likely landscape and visual effects for each potential site. The field survey was undertaken from publically accessible areas within 5 km of the substation search area. In order to confirm that the study area is appropriate, more distant areas shown on the indicative ZTV were also visited. It was judged that effects would not be significant in these more distant areas and that the proposed study area is appropriate.

Designated Areas

7.4.3.4 **Figure 7-9** presents the landscape designations within the study area. Part of the study area is located within a locally designated ILA, as identified by the ERYC. This includes part of the study areas for the onshore ECC and for the onshore substation, to the south-west of Beverley.

Landscape Character

7.4.3.5 National and Local Landscape Character Areas that could be affected by Hornsea Four activities are shown in **Figure 7-10**. Most of the study area is in the Holderness National Character Area, with a small area extending into the Yorkshire Wolds National Character Area to the west of Beverley. It encompasses the following local landscape character types, as identified by ERYC: Coastal Farmland; Open Farmland; Low Lying Drained Farmland; Sloping Farmland (Edge of Wolds); and Farmed Urban Fringe.



Hornsea Four

LVIA Study Area and Local Landscape Designations

Figure: 7.9

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Checked by: CB
Approved by: NL

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500000 510000 520000

460000 450000 440000

YORKSHIRE WOLDS

HOLDERNESS

HUMBER ESTUARY

B R I D

H O L D E R N E S S

GRID NORTH

Source: © Crown copyright and database rights [2018] Ordnance Survey 0100031673
Source: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Name: H4SR_7.10_LandUseFig02_NationalLocalLandscapeCharacter_A3Por_BNG Date: 08/10/2018 Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works
- National Character Areas (Natural England)

Local Character Areas (East Riding of Yorkshire Council)

- Central Dissected Plateau
- Coastal Farmland
- Farmed Urban Fringe
- Jurassic Hills Farmland
- Low Lying Drained Farmland
- Open Farmland
- Open High Rolling Farmland
- Sloping Farmland (Edge of Wolds)
- Sloping Wooded Farmland
- Urban
- Wolds Valley Farmland

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

National and local landscape character areas

Figure: 7.10

Document no: H4SR_7.10
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Checked by: CB
Approved by: NL

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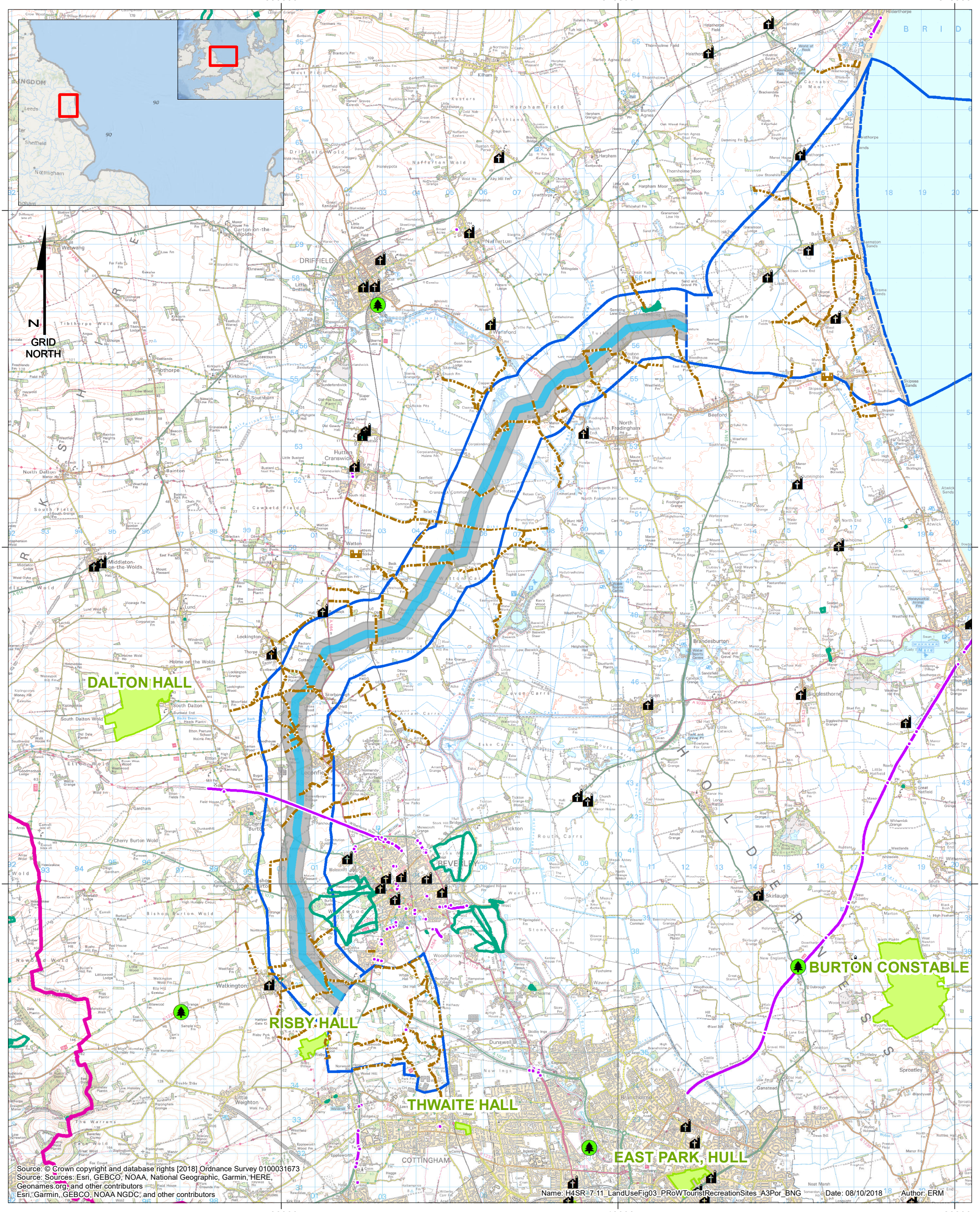
Visual Receptors

7.4.3.6 People in the following locations across the study area have the potential to be affected by the onshore project components:

- settlements (towns, villages, hamlets) near the onshore substation including Beverley, Cottingham, Skidby, Bentley and Walkington;
- individual farms and residential properties within the area of land between Creyke Beck substation to the east, the A1079 to the north, the A164 to the west, and Cottingham Golf Course to the south;
- roads including those designated as tourist routes (A roads – A1079 and A164, B roads – B1230 and B1233, and unclassified roads within the area of land described above);
- PRoW including national cycling trails (National Cycle Network route 1) and longer distance routes (Beverley 20, Wilberforce Way Cycle Route, Minster Way) as well as local footpaths and bridleways west of Creyke Beck substation;
- recreational and tourist sites such as beaches (at the landfall), golf courses (e.g. Cottingham Golf Course/Skidby Lakes Golf Club), parks and public open space (e.g. Crowle Park, Model Farm), Beverley Minster and other landmarks (e.g. St. Mary the Virgin church in Cottingham); and
- people at their places of work for example agricultural workers in fields and glasshouses.

7.4.3.7 **Figure 7-11** indicates locations that are likely to be considered to include sensitive visual receptors. Representative viewpoints for different types of visual receptor will be selected for assessment, and the effects on views from the various types of receptor listed above will be described. A refined ZTV map will be prepared for the onshore substation, and will inform the location of representative assessment viewpoints.

7.4.3.8 Photomontages (visualisations) will be prepared for four representative viewpoints of the onshore substation and will be shown alongside photographs of the existing views. Consideration will be given to representing visual receptors in locations where the setting of cultural heritage features could be altered. Photomontages will not be necessary for the onshore ECC as the operational cabling will be underground, and there is no potential for significant visual effects once restoration after construction, and replanting of any hedgerows which are removed, has been completed.



- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works
- Churches
- Cycleways (Department for Transport)
- Public Rights of Way (East Riding of Yorkshire Council)
- National Trails (Natural England)
- Countryside Rights of Way Access Land (Natural England)
- Parks and Gardens (Historic England)

Tourist/Recreation Sites (Open Street Mapping)

- Castle
- Park

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

PRoW, Tourist and Recreation Sites

Figure: 7.11

Document no: H4SR_7.11
Created by: AA
Checked by: CB
Approved by: NL

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Summary and Key Issues

7.4.3.9 RPSS for the onshore substation and onshore ECC has reduced the potential for significant landscape and visual effects, though seeking and making commitments to avoid the more sensitive sites (e.g. hedgerows, woodlands, other areas of semi-natural vegetation, river crossings, proximity to settlement and residential properties). The presence of existing woodland has been considered in terms of its potential to reduce the visual effects of the onshore substation, through providing existing mature screening.

7.4.4 Project Basis for Scoping Assessment

7.4.4.1 The landscape and visual scoping assessment is based on the following:

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.
- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.
- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.
- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.
- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.
- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.
- Construction activity will occur and landscape features could be temporarily affected within the substation search area, the landfall search area and the 700 m indicative temporary works area and 200 m indicative permanent cable area of the ECC

respectively, noting that the locations and extents of activities will be refined as route planning and site selection and design progress, reducing to the dimensions of land affected noted above.

- Views could be affected within a 5 km buffer for the onshore substation search area and 2 km buffer for the onshore ECC 700 m indicative temporary works area and landfall search area.

- The offshore operational facilities will be 65 km from shore to the closest part of the wind farm site.

7.4.4.2 The basis for assessment also includes the embedded mitigation where appropriate.

7.4.5 Embedded Mitigation

7.4.5.1 As part of the design process, several designed-in measures have been proposed to reduce the potential for impacts on landscape and views (see Table 7-12). These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in Annex A.

7.4.5.2 As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four. They have, therefore, been considered in the assessment presented in Section 7.4.6 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 7-12 Relevant Landscape and Visual Commitments

ID	Measure Proposed	How the measure will be secured
Co1	Primary: All natural watercourses including main rivers and ordinary watercourses (not artificial drainage ditches, flood defences), main roads and railways will be crossed by HDD or other trenchless technology where technically practical.	CoCP and DCO requirement
Co2	Primary: Where practical the following sensitive sites will be avoided by the permanent project footprint: SSSI Units, Ancient woodland, areas of consented development, areas of historic landfill and other known areas of potential contamination, RSPB reserves, Local Nature Reserves, Local Wildlife Sites, Yorkshire Wildlife Trust Sites, National Trust Land, Listing Buildings and Scheduled Monuments. Where possible, unprotected areas of woodland, mature and protected trees (those with Tree Preservation Orders, TPOs) shall also be avoided.	DCO Works Plans and Order limits
Co7	Primary: The construction working area will typically be 80m working width along the underground cable route to minimise the	DCO Works Plans and Order limits

ID	Measure Proposed	How the measure will be secured
	construction footprint. Other crossings may expand this default to greater than 80m (HDD and local factors, over small lengths). The permanent width will be 60m.	
Co10	Tertiary: Post-construction the working area shall be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.	CoCP and DCO requirement
Co25	Primary: The onshore cable route will be completely buried underground for its entire length.	DCO Works Plans, description of development and requirements
Co26	Tertiary: Hedgerows and vegetation will be retained where possible. Where it is not possible to retain them, hedgerows will be removed prior to topsoil removal. The width of hedge and vegetation removed will be limited where practical.	DCO Works Plans an CoCP
Co28	Primary: Joint Bays will be completely buried, with the land above reinstated excepting link box chambers where access will be required from ground level, e.g. via manholes.	DCO Works Plans, description of development and requirements
Co49	Primary: There will be no permanent High Voltage infrastructure installed above surface within 50m of residential properties and sub surface within 25m of residential properties.	DCO Works Plans
Co64	Tertiary: During construction of the cable trenches the topsoil and subsoil will be stripped and stored on site within the temporary working corridor of the Hornsea Four onshore cable corridor. The topsoil and subsoil will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). No material will be stockpiled within the floodzone of any watercourse.	CoCP and DCO requirement
Co78	Primary: Micro-siting will be undertaken during detailed design to avoid all ponds if practical.	DCO Works Plans
Co127	Tertiary: A Decommissioning Plan or method statement will be agreed with the removal of all onshore above ground infrastructure	DCO requirement
Co128	Tertiary: Appropriate sites will be selected through the RPSS process for onshore construction compounds. Good construction practice will be applied.	CoCP

7.4.6 Likely Significant Effects

7.4.6.1 Table 7-13 sets out an assessment of effects on landscape and visual amenity at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design

process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.4.6.2 The assessment presented in **Table 7-10** is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in **Table 7-9**, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for landscape and visual effects; relevant policy; the assessment criteria provided in **Annex C**; the question-led approach set out in **Section 1.7**; and the professional judgement of qualified landscape architects .

7.4.6.3 **Table 7-10** is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.4.6.4 Where a simple assessment is proposed:

- effects on receptors will be grouped and may be generic (for example consideration of views of the working width for the onshore ECC from properties and PRoW will not be made on a house by house, or PRoW by PRoW, basis); and
- no ZTV or photomontages will be provided, given this is not necessary for temporary works or elements which will be beneath the ground surface.

7.4.6.5 Where a detailed assessment is proposed:

- effects on receptors will be considered individually or within smaller groups where there is potential for long term significant effects at close range; and
- a ZTV and photomontages for the onshore substation will be provided, from four viewpoints.

7.4.6.6 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 7-13 Likely Effects – Landscape and Visual Assessment

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Temporary effects on landscape and viewers of marine works: construction phase Temporary impacts of the construction of offshore elements of Hornsea Four on onshore landscape and visual receptors (e.g. ships and cranes visible from the shore).	Primary Distance of offshore works from land based receptors.	Negligible	Medium	**No likely significant effects**	**Scoped out** See **Section 7.4.7**.	N/A
Permanent effects on landscape and viewers of marine infrastructure: operational phase Permanent impacts of the offshore elements of Hornsea Four on onshore landscape and visual receptors (e.g. booster station and wind turbine generators visible from the shore).	Primary Distance of permanent offshore infrastructure from land based receptors.	Negligible	Medium	**No likely significant effects**	**Scoped out** See **Section 7.4.7**.	nN/A
Temporary effects: Construction phase Construction activity associated with the landfall, and onshore ECC will temporarily occupy the landfall work area, the ECC working width, compounds and means of access, leading to loss of landscape features and a change to landscape character and to views.	Primary Co2 Co49 Co128	Medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** Temporary loss of landscape features such as hedgerows that will then require replanting.	Scoped in A simple assessment approach will be adopted involving survey, identification of features of value to feed into location-specific restoration and reinstatement measures.	Surveys to inform an understanding of landscape features, character and existing views which may be affected.

Permanent/long-term effects resulting from construction activities: operational phase Permanent impact of the landfall and onshore ECR may affect designated and non- designated landscape receptors (including landscape features such as woodlands and hedgerows).	Primary: Co25	Negligible	Likely to range from negligible to low	**No likely significant effects** Some landscape features in these areas will be removed during construction. Fences, walls and ditches along field boundaries will be reinstated within one year. Areas of woodland and hedgerow are assumed to be replanted within five years.	**Scoped out**	Surveys to inform an understanding of landscape features, character and existing views which may be affected.
Permanent /long-term effects resulting from construction activities: operational phase Permanent impact of the landfall, and onshore ECC may affect visual receptors in settlements and at individual properties, along key routes (national trails and tourist routes), along other roads and public rights of way, and in accessible and recreational landscapes.	Primary: Co25	Negligible	Likely to range from low to high	**No likely significant effects** Some views will be temporarily affected for a period of one year, after which they will be reinstated, other than areas of woodland and hedgerows which are assumed to be replanted within five years.	**Scoped out**	Surveys to inform an understanding of landscape features, character and existing views which may be affected.
Temporary effects on landscape and viewers of the onshore substation site: **construction phase** Construction activity associated with the onshore substation will temporarily occupy the substation construction area, compounds and means of access, leading to loss of	Primary: Co2 Co25 Co26 Co49 Co78 Co128 Tertiary: Co7	Medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** Potentially significant without secondary mitigation such as replanting of sections of hedgerow which may need to be removed.	Scoped in A simple assessment approach will be adopted involving survey, identification of features of value to feed into location-specific restoration and reinstatement measures.	Surveys to inform an understanding of landscape features, character and existing views which may be affected during construction.

landscape features and a change to landscape character and to views. Changes to views may affect visual receptors in settlements and at individual properties, along key routes (national trails and tourist routes), along other roads and public rights of way, and in accessible and recreational landscapes	Co10					
Permanent effects on landscape and viewers of the onshore substation site: **Operational phase** Operation of the onshore substation will permanently occupy land which is currently characterised by agricultural use, with hedgerows and woodlands beyond, leading to loss of landscape features, and a change to landscape character and to views.	Primary: Co2	Medium to large	Likely to range from low to high	**Likely significant effects without secondary mitigation** Potentially significant without secondary mitigation such as planting new hedgerows and woodland to help screen the new infrastructure from views and to integrate it into the landscape.	Scoped in A detailed assessment will be adopted involving survey, identification of features of value and to feed into location-specific mitigation including earth modelling and woodland and hedgerow planting. A selection of photomontages will be provided.	Surveys to inform an understanding of landscape features, character and existing views which may be affected during construction.
Temporary effects on landscape and viewers: **Decommissioning phase** Decommissioning of all works could affect the landscape and views	Tertiary: Co127	Medium to large scale, but short duration	Likely to range from low to high	No likely significant effects	Scoped out	N/A

7.4.7 Impacts Scoped Out of Assessment

7.4.7.1 The offshore HVAC booster (including any lighting on it) and offshore wind turbine generators could result in landscape and visual effects which are experienced from land based receptors, including the closest land at Flamborough Head, which rises to over 50 m Above Ordnance Datum.

7.4.7.2 In practice the siting and design process has aimed to reduce or remove this potential, through seeking to locate the offshore HVAC booster and offshore wind turbine generators a considerable distance from the nearest shore.

7.4.7.3 As a result, at present, any further consideration of these effects is scoped out. This is on the basis that they are likely to be close to or below the horizon at the distances from shore which are proposed, because of the curvature of the earth. Given the land is relatively low lying, the potential for the availability of widespread elevated views is limited. This, combined with atmospheric visibility, means that significant visual effects across areas of land are considered unlikely.

7.4.7.4 The potential for effects from offshore components on onshore landscape and visual receptors will be kept under review and revisited as the proposals develop, in terms of their precise location, maximum height and need for lighting.

7.4.8 Proposed Approach to the PEIR and ES

7.4.8.1 The PEIR will consider potential effects on designated landscapes, landscape character and on views and visual amenity. The assessment will be informed by a combination of desk based assessment and field based surveys (as outlined above), with consultation to be held with relevant statutory and non-statutory organisations as necessary throughout the process.

7.4.8.2 The significance of effects will be determined using standard impact assessment methods and criteria such as the Guidelines for Landscape and Visual Impact Assessment, (Landscape Institute and IEMA, 2013). The assessment will take into account the magnitude (size, scale, geographic extent, duration, reversibility) of the impact and the sensitivity (susceptibility and value) of affected receptors to a particular impact as defined in **Annex C**.

7.4.8.3 Potential effects will be described and the assessment will include consideration of potential cumulative effects as appropriate.

7.4.8.4 Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts and suitable opportunities to enhance the landscape and views will also be developed. The significance of residual effects remaining after implementation of proposed secondary mitigation measures will be presented.

7.4.8.5 A detailed assessment of the landscape and visual effects of operation of the onshore substation will be required on the following basis.

- The substation is likely to replace agricultural land and may require the removal of some sections of hedgerow or other field boundaries. It may require some changes in land level and topography, though cut and fill associated with making a construction platform and bunding. Planting may be proposed as secondary visual mitigation, to offset vegetation loss and to restore the landscape structure, if appropriate. These changes will alter the landscape resource and have the potential to permanently affect landscape character.

- The substation will become a new feature in views experienced by people in areas around the site, including in settlements, in residential properties, on roads and on PRoW. Secondary mitigation measures including bunding and new planting may be proposed if required to reduce visual effects. The height, form and materials to be used in structures will affect the nature and degree of visual effects, as will elements such as fencing, signage and lighting.

7.4.8.6 A simple assessment of the landscape and visual effects of the landfall, onshore ECC and onshore substation during construction will be required on the following basis.

- For buried elements it is assumed that the landscape in these areas will be temporarily lost and views affected for a period of one year, after which time they will be reinstated, other than areas of shrub and hedgerow which are assumed to be reinstated within five years. In the case of construction compounds it is assumed that the landscape will be lost and views could be affected for longer periods, but will be reinstated within the same periods as noted above.

- The landfall, onshore ECC and onshore substation will predominantly be within agricultural land, which is subject to seasonal disturbance in arable areas. The installation of buried cabling within such areas is not likely to result in any significant landscape and visual effects, once the construction areas have been restored and the land put back to previous uses. If sections of hedgerow, fences, walls and ditches need to be removed for construction, the gaps will be replaced or replanted once work is complete. There will be temporary landscape and visual effects during construction and until newly planted vegetation has become established, but given the phased nature of the works the duration of the effect at any given location will be limited, reducing the potential for effects to be significant.

- Whilst the onshore ECC will pass through the locally designated ILA, this is likely to be over a short distance and the trenching and working corridor will be completely restored to previous land uses after the cabling has been installed.

7.4.9 Scoping Questions for Consultees

7.4.9.1 Scoping questions for ERYC in relation to landscape and visual assessment include:

1. Do you agree that all the designated landscapes within the study area and shown on **Figure 7-9** have been identified?
2. Do you agree that all relevant sources of secondary data have been accessed for scoping or identitified for use in the EIA?
3. Is there any other baseline information that should be considered?
4. Is there any other guidance that should be taken account of?
5. Do you agree that a ZTV and visualisations should be prepared for the pernanent onshore substation but not for the temporary construction activities along the onshore ECC?
6. Do you have suggestions as to potential viewpoints that should be considered during the EIA process?

7.5 Historic Environment

7.5.1 Introduction

7.5.1.1 This section of the Scoping Report identifies the historic environment interests of relevance to Hornsea Four and considers the potential impacts and effects from construction, operation (including maintenance) and, where relevant, decommissioning activities (i.e. landward of MHWS) of Hornsea Four. The potential for likely significant effects on the historic environment is largely limited to the construction phase because that is when the virtually all the ground breaking work will occur; during operation the cables will be buried and only the substation cold have an indirect impact on the setting of historic environment assets.

7.5.2 Study Area

7.5.2.1 The general study area for which data were requested from the Humber Historic Environment Record (HHER) and obtained from online sources listed in **Section** Error! R eference source not found. comprises the scoping boundary. **Section 7.5.4**presents the historic environment baseline context for the study area and **Table 7-15** identifies those features that are located within the 700 m indicative temporary works area. The historic environment seaward of MHWS is addressed in **Section 6.7** Marine Archaeology. It should be noted that the study area will be reviewed and amended in response to such matters as refinement in siting and routing of onshore project elements and the identification of additional impact pathways (e.g. identified potential impacts on identified heritage assets resulting from changes to their setting).

7.5.3 Baseline Environment

Data Sources used for Scoping

7.5.3.1 A desk-study was undertaken to obtain information on designated and non-designated heritage assets within the Hornsea Four study area. Data were requested within the study area for designated and non-designated heritage assets. The following sources of information in **Table 7-14** were consulted:

Table 7-14 Key Sources of Historic Environment Data

Source	Summary	Coverage of Hornsea Four Development Area
British Geological Survey (BGS)	BGS for information on local and regional geology (available online: https://www.bgs.ac.uk/data/mapViewers/home.html?src=topNav).	Full coverage of the Hornsea Four onshore scoping boundary.
National Heritage List for England (NHLE), maintained by Historic England	National Heritage List for England (NHLE), for information on designated heritage assets (Scheduled Monuments, Listed Buildings, Registered Parks and Gardens, Registered Battlefields and World Heritage Sites) (available online: https://historicengland.org.uk/listing/the-list/).	Full coverage of the Hornsea Four onshore scoping boundary.
National Library of Scotland (NLS)	Historic mapping (The NLS holds UK wide historic mapping) (available online: https://www.nls.uk/).	Full coverage of the Hornsea Four onshore scoping boundary.
Humber Historic Environment Record (HHER)	Information on non-designated heritage assets and information on historic mapping, including pre-Ordnance Survey maps, historic air photographs and published and unpublished documentary sources.	Full coverage of the Hornsea Four onshore scoping boundary.
INSPIRE GIS	Dataset for Conservation areas in England (2014) (no longer available online).	Full coverage of the Hornsea Four onshore scoping boundary.
ERYC	Information on Conservation Area appraisals; no mapping for these is currently available (appraisals available online: http://www2.eastriding.gov.uk/environment/planning-and-building-control/planning-in-conservation-areas/conservation-areas/).	Full coverage of the Hornsea Four onshore scoping boundary.

7.5.3.2 An aerial photographic transcription has been undertaken as part of the scoping process using a standard and approved methodology by suitably experienced and trained historic environment specialists.

7.5.3.3 Designated and non-designated heritage assets that could be affected by Hornsea Four activities are shown in **Annex I**.

Baseline Environment

7.5.3.4 The Upper Palaeolithic, Mesolithic and early Neolithic archaeological resource comprises find spots of struck-flint artefacts and the debris of their manufacture toward the northern end of the study area for scoping. They suggest that mobile communities exploited the floral and faunal resources of a chain of Late Glacial freshwater lakes or meres that ran from Skipsea, through Ulrome and Beeford to Barmston.

7.5.3.5 Communities started to become more sedentary and more fixed in the landscape from the later Neolithic, as is evidenced by an oval enclosure or the outer ditch of a ploughed-down oval barrow (burial mound) which is visible as cropmarks within the study area at Barmston. Similarly, the cropmark remains of a possible late-Neolithic henge, visible at Woodmansey, suggest the growth of more rooted communities within the study area. Those rooted communities were perhaps asserting ancestral claims to land by the early Bronze Age in the form of round barrows, which are depicted on historic mapping or are visible as cropmarks on aerial photographs singly or in pairs at 11 locations along the entire length of the study area.

7.5.3.6 'Ancient British Urns' found at Rotsea and an inhumation cemetery at Bryan Mills may both be flat cemeteries of middle or late Bronze Age date. Only two potential settlement sites of Bronze Age date are known within the study area, at Barmston and Ulrome. High-status later Bronze Age metalwork, comprising a bronze sword, spearheads, and axes, have been recovered from eight locations within the study area. Their topographical contexts suggest that many of these artefacts were deposited in watery environments, including the River Hull and its tributaries. They may have been propitiatory offering at a time of climatic deterioration and raised sea levels that led to the flooding of the Hull Valley and its tributaries and the spread of wetlands across their valley floors. Such wet conditions prevailed throughout the Iron Age, ameliorated during the Roman period and reoccurred during the early part of the early medieval period, limiting settlement at these locations during those times.

7.5.3.7 A distinctive material culture that archaeologists have called the 'Arras Culture', from the site close to Market Weighton where they first identified it, prevailed throughout East Yorkshire from about 450 to about 100 BC. In the second century AD, the Roman geographer Ptolemy would name the resident tribe within East Yorkshire as the Parisi. One element of that material culture is burial within a square barrow, a subset of which contained high-status chariot burials. Square barrows survive as cropmarks on aerial photographs, usually in small groups, at six locations within the study area and as low earthworks comprising a larger cemetery containing about 120 square barrows just south of it at Scorborough.

7.5.3.8 Settlement sites of Iron Age or Roman date, once again visible principally as cropmarks on aerial photographs, are known at 20 locations within the study area. Communities within

East Yorkshire were slow to adopt Romanised lifestyles and their associated material culture. Consequently, it is not possible to separate Iron Age from Roman settlements before excavation. A single possible Roman villa has been identified in the cropmark record within the study area, at Skidby.

7.5.3.9 The Humber Historic Environment Record contains only four entries for the early medieval period within the study area, although the wider area also contains the archaeological remains of the earliest phases of Beverley Minster, then known as Inderauda. It was founded at the turn of the 8th century within the wood of the Deirans as a spiritual powerhouse and refounded after the reconquest from the Danes by King Athelstan in the 10th century. Although the contribution made by the early medieval period to the historic environment resource within the study area would appear to be slight, it is during the later centuries of that period that many of East Yorkshire's settlements and their open-field systems, which would flourish during the medieval period, were established.

7.5.3.10 The medieval resource is much more extensive. There are no monastic sites within the study area, but it does contain parts of the sites of two monastic granges (farm estates exploited by lay brethren for the direct supply of produce to a monastery) at Beeford and Lockington (Belagh Grange). Moats, which flourished between about 1150 and 1350 and contained the houses and gardens of manorial lords and prosperous peasants and lodges within deer parks, are known at four locations within the study area. The sites of deer parks lie partially within it at Leconfield, Bentley, Skidby and Cottingham, Risby, and Beverley and Woodmansey.

7.5.3.11 During the late medieval and early post-medieval periods, many villages shrank or were deserted because of the effects of the Black Death of 1348/9 and subsequent outbreaks of bubonic plague. These took away the market for grain, leading lords to eject the peasantry and to put the land down to pasture, and at the same time reducing the size of the labour market, creating opportunity and encouraging peasant migration. Deserted or shrunken settlements lie entirely or partially within the 500m study area at Wilsthorpe, Auburn, Hartburn (Fraisthorpe), Winkton (Barmston), Gembling, Raventhorpe (Cherry Burton), Risby, Winthorpe (Etton) and Bentley. Beverley Minster and most parish churches within the 5km study area were built in the medieval period and retain most or much of their medieval fabric.

7.5.3.12 The present-day historic landscape within and beyond the study area was, in very large part, formed during the post-medieval period. Sixty percent of the medieval open fields across the Holderness plain crossed by Hornsea Four were enclosed piecemeal or generally (wholesale) by private agreement between the late medieval period and 1730, while 40% of the open fields and most of the wastes were subject to general enclosure by Act of Parliament after that. The former process typically produced smaller and more sinuous hedged and ditched fields, while the latter often engendered larger, geometrical fields similarly demarcated. Except for some ecclesiastical buildings, most built-heritage assets within the study area and wider area, including most of the 450 built-heritage assets at Beverley, were constructed during this period. Formal gardens were laid out at Risby Hall during the late 17th century and were extended with pleasure grounds and

ornamental lakes a century later. The spine of the modern transport network was formed during this period, and the lines of 18th-century turnpike roads lie within the 500m study area at Beswick, Molescroft, Bishop Burton, and Rowley and Skidby, while the line of the extant Hull to Scarborough Railway, established in the 19th century, is crossed at Lockington.

7.5.3.13 The modern period (20th and 21st centuries) has both added to and taken from the heritage resource within and around the study area. It has added the large number of World War II pillboxes, anti-tank defences, searchlight batteries, observation posts and other military installations and structures, including the Royal Observer Corps underground monitoring post at Skipsea, a scheduled monument, which are common along the Holderness coast and were designed to repel the German invasion that never came. It has also added the former airfield at Lissett and the memorial to 158 Squadron, and a heavy anti-aircraft gun-site at Walkington, part of which is a scheduled monument. The modern period, however, has also witnessed the loss of meaning within parts of the historic landscape through the removal of historic hedgerows and the amalgamation of fields, and through loss of many buildings of heritage interest and the frequently insensitive use of non-traditional building forms and materials within historic villages and townscapes.

7.5.3.14 Key sensitive receptors are identified in **Table 7-15**. Those that are located within the 700 m indicative temporary works area are identified. Impacts on these receptors are predicted to be indirect; comprising changes (either temporary or permanent) to their setting. Key sensitive receptors are those heritage assets with the potential to experience a significant effect as a result of the construction and decommissioning of Hornsea Four. The heritage assets identified in **Table 7-15** are all designated. Non-designated assets also have the potential to be significantly affected by Hornsea Four. This potential will be determined at the PEIR phase.

Table 7-15 Historic Environment – Key Sensitive Receptors

Asset Name	NHLE List entry	Type/Grade	Assets located within the 700 m indicative temporary works area – yes/no
Church of All Saints	1083851	Listed Building, Grade I	No
Old Hall	1204832	Listed Building, Grade II*	No
Medieval complex at Barmston Old Hall	1007846	Scheduled Monument	No
Skipsea Castle	1011212	Scheduled Monument	No
Foston on the Wolds	-	Conservation Area	Yes
Church of St Andrew	1346653	Listed Building, Grade II*	No
Rotsea Medieval Settlement	1005212	Scheduled Monument	No
Beswick Hall	1103484	Scheduled Monument	No
Beswick	-	Conservation Area	No

Asset Name	NHLE List entry	Type/Grade	Assets located within the 700 m indicative temporary works area – yes/no
Church of St Mary	1310465	Listed Building, Grade I	No
Lockington	-	Conservation Area	No
Barf Hill Moated Site	1007717	Scheduled Monument	No
Church of St Leonard	1103451	Listed Building, Grade I	No
Square Barrow Cemetery at Scorborough	1015613	Scheduled Monument	No
Church of St Catherine	1103450	Listed Building, Grade I	No
Moated Site of Leconfield Castle	1103450	Scheduled Monument	No
Cherry Burton	-	Conservation Area	No
Moated site 80 m south of Parkhouse Farm	1007842	Scheduled Monument	No
Moated site 100m north of Parkhouse Farm	1008292	Scheduled Monument	No
Bishop Burton	-	Conservation Area	No
Church of All Saints	1103429	Listed Building, Grade II*	No
Bowl Barrow on westwood Common, 610m northwest of Blackmill	1013990	Scheduled Monument	No
Group of four square barrows on West wood Common, 200m north of Blackmill	1013944	Scheduled Monument	No
Romano-British enclosure on westwood Common, 510m southwest of Blackmill	1013999	Scheduled Monument	No
Church of All Hallows	1161425	Listed Building, Grade II*	No
Walkington	-	Conservation Area	No
Heavy Anti-Aircraft gunsite, 350m west of Butt Farm	1019186	Scheduled Monument	Yes
Beverley sanctuary limit stone, Bentley Cross	1012590	Scheduled Monument	Yes

Asset Name	NHLE List entry	Type/Grade	Assets located within the 700 m indicative temporary works area – yes/no
Bowl barrow 400m north of Highfield House	1007731	Scheduled Monument	No
Risby Hall	1001419	Registered Park and Garden, Grade II	No

Summary and Key Issues

7.5.3.15 The study area contains numerous non-designated and designated heritage assets (please refer to **Annex I** for Designated and Non-Designated Heritage Assets Map Book). Those heritage assets most sensitive to change include scheduled monuments, listed buildings, conservation areas and registered parks and gardens. Route planning and site selection work undertaken to date shows that direct, physical impacts on these assets can be avoided. The potential remains for non-physical impacts to these assets comprising changes to their setting, during construction and operation and maintenance. Construction and maintenance are short-term and temporary phases, while operation is long-term.

7.5.4 Project Basis for Scoping Assessment

7.5.4.1 The historic environment scoping assessment is based on the following assumptions.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.
- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.
- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.
- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the

onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.

- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.
- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.
- Non-designated and designated heritage assets could be directly affected within the temporary and permanent project footprint defined by the substation search area, the landfall search area and the 700 m indicative temporary works area and 200 m indicative permanent cable area of the ECC respectively. The locations and extents of activities will be refined as route planning and site selection and design progress allowing avoidance of assets.
- Non-designated and designated heritage assets could be indirectly affected through a change in setting within 2.5 km off construction activity and 5 km of the operational substation.
- Key elements of the historic landscape (including hedgerows) will be reinstated.
- In the case of construction compounds it is assumed that heritage assets may be affected through removal and/or compression.

7.5.5 Embedded Mitigation

7.5.5.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed to reduce the potential for impacts on the historic environment. These are presented in **Table 7-16**. These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

7.5.5.2 As a result of the commitment to implement these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **Section**

7.5.7 (i.e. the determination of magnitude of impact and significance of effect assumes implementation of these measures).

Table 7-16 Relevant Historic Environment Commitments

ID	Measure Proposed	How measure will be secured
CO2	Primary: Where practical the following sensitive sites will be avoided by the permanent project footprint: SSSI Units, ancient woodland, areas of consented development, areas of historic landfill and other known areas of potential contamination, RSPB reserves, Local Nature Reserves, Local Wildlife Sites, Yorkshire Wildlife Trust Sites, National Trust Land, Listing Buildings and Scheduled Monuments.	DCO Works Plans and Order limits
C10	Primary: Post-construction the working area shall be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.	CoCP and DCO requirement

7.5.6 Likely Significant Effects

Overview

7.5.6.1 Table 7-17 sets out an assessment of effects on historic environment at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.5.6.2 The assessment presented in Table 7-17 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 7-16, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for effects on the historic environment; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in Section 1.7; and the professional judgement of qualified archaeologists.

7.5.6.3 Table 7-17 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.5.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Simple Assessment

7.5.6.5 For historic environment, a simple assessment has three potential functions:

1 to address unknown aspects of the Scoping Assessment; or
2 to reach an understanding of the effect and complete the design and assessment; or
3 to reach an understanding of the likely effect that identifies the need for a detailed assessment.

7.5.6.6 Information obtained at scoping will be reviewed, and consideration given to other relevant specialist databases if appropriate. More detailed information on historic landscape character mapping potentially affected by the proposals may need to be gathered. Historical maps and aerial photographs, relevant books, journals, previous reports and appropriate geotechnical data may also need to be consulted. If the desk-based studies indicate that there are significant gaps in the information required, it may be necessary to undertake new field surveys. Field surveys would include a preliminary walkover of the area or route, to familiarise the surveyor with the lie of the land, to check current land-use, identify any visible cultural heritage assets, confirm relevant historic landscape character mapping and briefly check the condition of known assets. Statutory and, potentially, non-statutory stakeholders would be consulted.

Detailed Assessment

7.5.6.7 Detailed Assessment will be applied where there is the potential to cause significant effects on environmental resources, and where the extent of this is unclear after the previous study, and a detailed study is required to obtain sufficient information for an appropriate assessment. The aim is to establish a robust in-depth understanding of the potential beneficial and adverse consequences of the project in relation to the historic environment, where this resource is potentially important, and / or the impact on it is potentially large, but where sufficient information is lacking to determine one or both of these parameters, and detailed investigations are necessary to remedy the deficiency. Where these factors are already established, and sufficient information is available to determine any necessary mitigation and the significance of the effect then detailed assessment will not normally be required.

7.5.6.8 National sources and national aerial photograph collections, will be consulted where appropriate. Lists of designated sites, buildings and landscapes will also be consulted. Local HERs, probably the most comprehensive records of the historic environment resource, are an invaluable source of detail. There are many other national, specialist and local databases, and relevant ones will be researched to ensure that appropriate information is collected for the purpose of the study. Where desk-based studies suggest that available information is inadequate for the purpose of the assessment, it may be appropriate to undertake field surveys to enhance the data. These surveys may be non-intrusive or intrusive in nature and may include geophysical survey and / or trial trenching.

Table 7-17 Likely Effects – Historic Environment

Project Activity and Potential Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Direct impacts on designated heritage assets: Construction phase Construction activities which may lead to the disturbance of or removal of assets.	Avoidance of designated heritage assets through design	None	Medium to High	**No likely significant effect**	**Scoped out**	None
Indirect impacts on designated heritage assets: Construction Phase Construction activities which may lead a change in the setting of assets.		No change to large	Medium to High	**Likely significant effect without secondary mitigation**	Scoped in. A detailed assessment will be undertaken, including desk studyandwalkover survey to make setting assessment.	Results of walkover survey
Direct impacts on non-designated heritage assets: Construction phase Construction activities which may lead to disturbance of or removal of assets.		No change to large	Low to High	**Likely significant effect without secondary mitigation**	Scoped in. A detailed assessment will be undertaken, including desk study, walkover survey and geophysical survey.	Results of walkover survey and geophysical survey and targeted trial trenching, where appropriate, are required
Indirect impacts on non-designated heritage assets Construction Phase Construction activities which may lead a change in the setting of assets.		No change to large	Low to High	**Likely significant effect without secondary mitigation**	Scoped in. A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Indirect impacts on designated heritage assets Operation phase As a result of the presence of infrastructure in the landscape with the potential to result in a change in setting of assets.		No change to large	Medium to High	**Likely significant effect without secondary mitigation**	Scoped in. A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment), consultation and collaboration with the	None

					landscape and visual impact assessment.	
Indirect impacts on non-designated heritage assets Operation phase As a result of the presence of infrastructure in the landscape with the potential to result in a change in setting of assets.		No change to large	Low to High	**Likely significant effect without secondary mitigation**	Scoped in. A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Direct impacts on designated heritage assets: Decommissioning phase Decommissioning activities which may lead to the disturbance of or removal of assets.	Avoidance of designated heritage assets through design	None	Medium to High	**No likely significant effect**	**Scoped out**	None
Direct impacts on non-designated heritage assets Decommissioning phase Decommissioning activities which may lead to the disturbance of or removal of assets.		No change to large	Low to High	**Likely significant effect without secondary mitigation**	Scoped in. A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Indirect impacts on designated heritage assets Decommissioning phase Decommissioning activities which may lead a change in the setting of assets.		No change to large	Medium to High	**Likely significant effect without secondary mitigation**	Scoped in. A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Indirect impacts on non-designated heritage assets Decommissioning: Decommissioing activities which may lead a change in the setting of assets.		No change to large	Low to High	**Likely significant effect without secondary mitigation**	Scoped in. A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	Potential requirement for further geophysical survey depending on footprint of decommissioning works

7.5.7 Impacts Scoped Out of Assessment

7.5.7.1 Direct, physical impacts on designated heritage assets during construction and decommissioning have been scoped out of further assessment. This has been possible through avoidance of designated heritage assets through design refinement undertaken so far.

7.5.8 Proposed Approach to the PEIR and ES

7.5.8.1 The PEIR will consider potential effects on historic environment. The assessment will be informed by a combination of desk based assessment and field based surveys (as outlined above in **Table 7-17**), with consultation to be held with relevant statutory and non-statutory organisations as necessary throughout the process. The following next steps for the historic environment topic are proposed:

- produce a draft desk-based assessment;
- review and integrate aerial photographic transcription into baseline;
- engage with ecology and landscape teams to better understand the potential for impacts upon the historic environment resulting from proposed ecological and/or landscape mitigation;
- obtain input from other topics in regard to inter-related effects comprising information on zones of visual influence and noise modelling;
- undertake setting assessment for key sensitive receptors; and
- site walkover is provisionally programmed for November 2018 to identify key areas that may be targeted for geophysical surveys; and
- geophysical surveys are seasonally constrained and are programmed for the optimal period for specific survey techniques, these are provisionally programmed for January to March 2019. The results of geophysical survey will form part of the evidence base for the PEIR.

7.5.8.2 The study areas for the PEIR will be further refined considering:

- the wider historical and archaeological context of the Hornsea Four project area;
- direct impacts on heritage assets within construction areas;
- indirect impacts on non-designated and designated heritage assets within up to a 2.5 km study area extending in all directions from the boundary of the construction corridor; and
- indirect impacts on designated assets within a study area extending in all directions from the substation developed in collaboration with the landscape and visual impact assessment.

7.5.8.3 The level and significance of effect will be determined using impact assessment methods and criteria outlined in the Design Manual for Roads and Bridges (DMRB) HA 208/07 (Highways Agency *et al.*, 2007), supported by professional judgement and:

- Code of Conduct, Chartered Institute for Archaeologists, (CIfA, 2014a);

- Conservation Principles: Policies and Guidance for the Sustainable Management of the Historic Environment, (Historic England, Consultation Draft, November 2018);
- Historic Environment Good Practice Advice in Planning Note 3 (second edition): The Setting of Heritage Assets (Historic England, 2017);
- Standard and Guidance for Historic Environment Desk-Based Assessment, (CIfA, 2014b);
- Yorkshire Archaeological Research Framework: resource assessment (University of York, 2005); and
- Yorkshire Archaeological Research Framework: research agenda (University of York, 2007).

7.5.8.4 DMRB, while designed primarily for linear transport schemes, provides useful guidance in regard to Hornsea Four as it is nationally recognised and will be supplemented and enhanced through the use of the publications listed above and by professional judgement. The approach that will be applied to the assessment is summarised in **Annex C.**

7.5.8.5 Inputs from other topics for inter-related effects, resulting from potential ecology, noise, traffic, air quality, water resources and landscape and visual impacts, will be considered during assessment.

7.5.8.6 Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts and suitable opportunities to enhance the landscape and views will also be developed. The significance of residual effects remaining after implementation of proposed secondary mitigation measures will be presented. Potential effects will be described and the assessment will include consideration of potential cumulative effects as appropriate.

7.5.9 Scoping Questions for Consultees

7.5.9.1 Scoping questions for Historic England and the Humber Archaeology Partnership in relation to historic environment include:

1. Do you agree that the approach and method described are appropriate for assessment of potential impacts and effects on designated and non-designated heritage assets resulting from Hornsea Four?
2. Do you agree that all non-designated and designated heritage assets within the scoping boundary have been identified?
3. Which of the identified non-designated and designated assets within the scoping boundary are most likely to experience a change in significance as a result of changes in their setting?
4. Do you agree that all relevant sources of secondary data have been accessed for scoping or identified for use in the EIA?
5. Do you agree that analysis of high resolution aerial imagery (aerial transcription) together with non-invasive survey is sufficient to contribute to a characterisation of both known buried archaeology (where necessary) and unknown buried archaeology in areas identified through walkover survey?

6. Is there any other baseline information that should be considered?

7.6 Land Use and Agriculture

7.6.1 Introduction

7.6.1.1 This section of the Scoping Report identifies the onshore land use and agricultural interests of relevance to the Hornsea Four landfall, onshore ECC and onshore substation. The assessment will also include consideration of pedestrians, cyclists, equestrians and other recreational users who use the area. It considers the potential effects from construction, operation (including maintenance) and, where relevant, decommissioning activities (i.e. landward of MHWS) of Hornsea Four.

7.6.1.2 Due to the nature of Hornsea Four the potential for likely significant effects from the onshore component is largely limited to the construction phase since the cabling will be buried. However, some potentially significant effects may result from the operation of the onshore substation as the land take will be permanent. Cross-reference will be made to the landscape and visual amenity, traffic, air quality, noise and other assessments as appropriate.

7.6.1.3 The potential impacts on the following resources are considered:

- the quality of agricultural land, in particular the presence of the "best and most versatile" Grades 1, 2 and 3a land as set out by Agricultural Land Classification (ALC) Guidelines (MAFF,1988);
- agricultural holdings and farming enterprises; and
- public access and recreational resources, facilities and public rights of way (PRoWs).

7.6.2 Study Area

7.6.2.1 The study area for land use and agriculture is illustrated in **Figure 7-12** and is as defined as the area within the onshore scoping boundary for the onshore substation and landfall search areas and the indicative temporary work area for the onshore ECC.

7.6.2.2 Where applicable further consideration is also given to recreational receptors within 5 km in all directions from the onshore substation search area and 2 km from the indicative temporary works area for the onshore ECC and landfall search area as per the LVIA study area illustrated in **Figure 7-9**. These distances have been determined to ensure the potential impacts on recreational visual amenity are reflected in the assessment, beyond these distances it is unlikely that there will be any notable visibility of Hornsea Four during construction or operation.

7.6.2.3 It should be noted that the study area will be reviewed and amended in response to such matters as refinement of the onshore ECC as well as the proposed locations for the onshore substation. The EIA will consider the land directly affected by construction works

and hence will cover a smaller study area of land lying wholly within the area defined by the scoping boundary.

7.6.3 Baseline Environment

Data Sources used for Scoping

7.6.3.1 To obtain more detailed information on the recreational and agricultural aspects of the study area, a desk based review of literature and data-sets available will be undertaken. This study has highlighted the data sources set out in Figure 7-12, which will be consulted to inform the PEIR.

Table 7-18 Key Sources of Land Use Data

Source	Summary	Coverage of Hornsea Four development area
Ordnance Survey	OS Mapping indicating the locations of potential receptors including recreational and agricultural aspects of the study area.	Full coverage of the Hornsea Four onshore scoping boundary.
DEFRA	Review of Agricultural Land Commission maps of England (accessed via www.magic.gov.uk) and Government farming statistical data.	Full coverage of the Hornsea Four onshore scoping boundary.
Natural England	Access to Evidence – Regional Agricultural Classification Land Maps.	Full coverage of the Hornsea Four onshore scoping boundary.
Visit Britain	Review of web based data.	Full coverage of the Hornsea Four onshore scoping boundary.
Historic England	Literature and data sets from Historic England were reviewed to assess recreational and agricultural change.	Full coverage of the Hornsea Four onshore scoping boundary.
Sustrans	Web based data from the sustainable transport charity was reviewed for cycling and walking routes.	Full coverage of the Hornsea Four onshore scoping boundary.
East Riding of Yorkshire Council	Review of a definitive map of Public Rights of Way.	Full coverage of the Hornsea Four onshore scoping boundary.
Aerial Imagery	High resolution aerial imagery sourced for Hornsea Four by APEM.	Coverage of the indicative temporary works area.

Landfall

7.6.3.2 Agricultural land within the landfall area, located between Skipsea and Fraisthorpe is shown to predominantly comprise Grade 2 (very good) and Grade 3 (good to moderate) quality land, as illustrated in Figure 7-12. This land is therefore considered as the "best and most versatile" agricultural land.

500000 510000 520000

460000

450000

440000

N
GRID NORTH

Source: © Crown copyright and database rights [2018] Ordnance Survey 0100031673
Source: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Name: H4SR_7.12_LandUseFig04_AgrLandClassDesignations_A3Por_BNG Date: 08/10/2018 Author: ERM

Scoping Boundary
Scoping Boundary Component
Indicative Permanent Cable Area
Indicative Temporary Works

Agriculture Land Classification (Natural England)

Grade 2 (Very Good)
Grade 3 (Good to Moderate)
Grade 4 (Poor)
Non Agricultural
Urban

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres
0 1 2 3 4 Miles

Hornsea Four

Agricultural Land Classification

Figure: 7.12

Document no: H4SR_7.12
Created by: AA
Checked by: CB
Approved by: NL

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7.6.3.3 There are a number of recreational and tourism resources in this area, including Skipsea Sands Holiday Park, Southfield Caravan Park, Seaside Caravan Park and Barmston Beach Holiday Park. Beaches in the area are noted as being popular amongst kite surfers as a result of the wide, long relatively flat expanse of sand. There are also a number of PRoWs in proximity to the landfall area.

Onshore Export Cable Corridor

7.6.3.4 As illustrated in **Figure 7-12**, the inland section of the onshore ECC is shown to comprise a mixture of Grade 2 and Grade 3 land, with small isolated areas of land primarily in non-agricultural use. To the west of Beverley and the A614, land is shown to be predominantly Grade 2 land.

7.6.3.5 There are several areas of Access and Registered Common Land as defined by the Countryside and Rights of Way (CRoW) Act 2000 as conclusive open country (predominantly moor, heath, and down) within the indicative temporary working area for the onshore ECC as shown on **Figure 7-11**. The largest areas are located around Beverley town, in particular, to the west centred around Westwood; to the north-east near Tickton; and to the south-east adjacent to the village of Weel. Gembling Green, a smaller area, is located further to the west, adjacent to the hamlet of Gembling. Nearer the coast, the area adjacent to Skipsea Castle is subject to Section 15 of the CRoW Act 2000 and as such was subject to pre-existing access rights prior to the CRoW Act.

7.6.3.6 There are numerous PRoW routes within the onshore scoping boundary as illustrated in **Figure 7-11**. The following cycle routes are also located within the scoping boundary:

- Route 1 - Yorkshire Wolds Cycle route: a long distance cycle route connecting Dover and the Shetland Islands;
- Route 66 - Yorkshire Wolds Cycle route: a long distance cycle route from central Manchester to Spurn Head via Bradford, Leeds, York, Beverley, and Kingston upon Hull; and
- Route 164 – Way of the Roses: the southern section of a two part route through the Yorkshire Wolds from Pocklington to Hutton Cranswick, and part of the Way of the Roses coast to coast cycle route.

7.6.3.7 Other recreational resources located within the study area include Beverley Race Course, Cherry Burton Golf Course and local tourist attractions such as Skipsea Castle and Beverley Minster.

Summary and Key Issues

7.6.3.8 Initial RPSS for the onshore project components was undertaken in such a manner as to avoid constraints, and therefore any potential significant impacts where possible. This was achieved through comparative analysis of route options, resulting in the preferred corridor to the west of Beverley being identified. The onshore ECC will primarily affect agricultural

land during construction. However, the onshore substation will affect agricultural land during both construction and operation.

7.6.3.9 Additionally, there are several PRoWs within the onshore ECC that could be affected during construction, resulting in the temporary severance and diversion of routes. Once operational, the buried cabling will not affect these PRoW or the agricultural use of the land. Since the cabling will be underground, it will also not affect tourist or recreational sites, or access to them.

7.6.3.10 The onshore substation will require a permanent land take and therefore has the potential to affect agricultural land use long-term, and could potentially require localised alterations to PRoW. The onshore substation may be visible from tourist and recreational sites and may influence access to them, but it will not affect them directly as such sites (and associated access) will be avoided as part of the primary mitigation.

7.6.4 Project Basis for Scoping Assessment

7.6.4.1 The land use and agriculture scoping assessment is based on the following.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.

- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.

- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.

- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m all within its footprint.

- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.

- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.

- Land uses could be directly affected within the temporary and permanent project footprint defined by the substation search area, the landfall search area and the 700 m indicative temporary works area and 200 m indicative permanent cable area of the ECC respectively. The locations and extents of activities will be refined as route planning and site selection and design progress (with inputs from consultation with landowners) allowing avoidance of sensitive land uses.

- Land use could be affected beyond the above areas (e.g. by severance, changes in visual amenity) over a wider area comprising an additional 5 km buffer for the onshore substation and landfall search area and 2 km buffer for the onshore ECC indicative temporary works area.

7.6.4.2 For the purposes of assessment, it has been assumed that there will be permanent loss of agricultural land in the operational onshore substation area. Only temporary loss of agricultural land will occur in relation to the onshore ECC. In the case of recreational receptors within the scoping boundary and onshore ECC indicative temporary works area, there is the potential for total severance of PRoWs for the duration of the construction period. Access to tourist and recreational facilities may also be temporarily restricted at times of construction activity local to them.

7.6.4.3 The basis for assessment includes the embedded mitigation where appropriate.

7.6.5 Embedded Mitigation

7.6.5.1 As part of the project design process, a number of designed-in measures, referred to as primary mitigation, have been proposed to reduce the potential for impacts on land use and agriculture (see **Table 7-19**). These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

7.6.5.2 As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of Hornsea Four and have, therefore, been considered in the assessment presented in Section 7.6.6 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 7-19 Relevant Land Use and Agriculture Commitments

ID	Measure Proposed	How the measure will be secured
Co10	Tertiary: Post-construction the working area shall be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.	CoCP and DCO requirement
Co79	Primary: Signage and/or temporary PRoWs/footpath diversions will be provided during construction.	CoCP
Co80	Primary: A crossing schedule will be provided which includes crossing methodology for each crossing of road, rail, PRoW and watercourse.	CoCP and DCO requirement
Co124	Tertiary: Adoption of an agreed Construction Code of Practice to minimise temporary disturbance to residential properties, recreational users, and existing land users.	CoCP
Co127	Tertiary: A Decommissioning Plan or method statement will be agreed with the removal of all onshore above ground infrastructure.	

7.6.6 Likely Significant Effects

7.6.6.1 Table 7-20 sets out an assessment of effects on land use and agriculture at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.6.6.2 The assessment presented in Table 7-20 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 7-19, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for land use and agriculture effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in Section 1.7; and the professional judgement of qualified land use experts.

7.6.6.3 Table 7-20 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.6.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in Chapter 8 Cumulative Effects.

Table 7-20 Likely Effects – Land Use and Agriculture

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
Temporary disruption / reduction in land: Construction phase Impacts of construction on agricultural land and farm holdings resulting in temporary disruption or reduction in land available for farming activities.	Tertiary: Co10	Medium	High	**Likely significant effects without secondary mitigation.** The scoping boundary includes agricultural land and areas considered "Best and most versatile" agricultural land (ALC Grades 1, 2 and 3a) may be affected.	Scoped in Detailed assessment will include a desktop study of agricultural land affected by Hornsea Four.	N/A
Temporary disruption: Construction phase: Impacts of construction may affect recreational use of the coast through temporary disruption to beach access and coastal paths.	Primary: Co79	Small	Low	**No likely significant effects** Local recreational resources will only be affected for the duration of the construction works.	**Scoped out**	N/A
Impacts on recreation and amenity: Construction phase Impacts of construction may affect recreational resources and amenity (noise, dust, and traffic movements)	Tertiary: Co124	Medium	Medium	**Likely significant effects without secondary mitigation.** Local recreational resources and visitor attractions will only be affected for the duration of the works.	Scoped in Simple assessment will include a desktop review of recreational resources which are likely to be affected.	N/A
Severance, temporary diversion or closure: Construction phase Impacts of construction may affect National Cycle network Routes, other PRoW and promoted routes, resulting in severance, temporary diversion or closure.	Primary: Co79	Medium	High	**Likely significant effects without secondary mitigation.** There are National Cycle Network routes, other PRoWs and promoted routes within the onshore scoping boundary.	Scoped in Detailed assessment will include a desktop review of PRoWs, National Cycle Network routes and other recreational routes and a targeted walkover survey to establish their nature and condition.	Targeted site walkovers will be required.

Permanent disruption / reduction of land: Operation and maintenance phase Impacts of operation and maintenance of the cable route corridor and onshore substation may affect Agricultural Land and farm holdings, resulting in permanent disruption or reduction in land available for farming activities.	Tertiary: Co10	Negligible	High	**No likely significant effects** The onshore ECC search areas are on agricultural land and areas considered "Best and most versatile" agricultural land (ALC Grades 1, 2 and 3a) may be affected. They may also be affected temporarily if sections of cable need to be uncovered for repair/investigation although impacts would be minimal and likely short lived.	**Scoped out**	N/A
Temporary disruption / reduction in land: Decommissioning phase Impacts of decommissioning above ground installations may temporarily affect Agricultural Land and farm holdings, resulting in temporary disruption or reduction in land available for farming activities.	Tertiary: Co127	Negligible	High	**No likely significant effects** The onshore ECC and substation search areas are on agricultural land and areas considered "Best and most versatile" agricultural land (ALC Grades 1, 2 and 3a). Impacts are expected to be minimal however as above ground installations are small and cabling will remain in-situ.	**Scoped out**	N/A

7.6.7 Proposed Approach to the PEIR and ES

7.6.7.1 The assessment will consider potential effects on agricultural land and land use, including tourism and recreational resources. The assessment will be informed by a combination of desk based assessment and field based surveys (as outlined above), with consultation to be held with relevant statutory and non-statutory organisations as necessary throughout the process.

7.6.7.2 There are no standard criteria for assessing environmental effects on land use and agriculture. Therefore consideration is given to the guidance that is provided on these topics in the DMRB and is summarised in **Annex C.** Although these methodologies are predominantly used for highways and bridge projects, the overarching approaches can also be applied to linear infrastructure developments such as the onshore export cables for Hornsea Four. Interim Advice Note 125/15 of the DMRB explains that assessment should consist of an amalgamation of DMRB, Volume 11, Section 3, Part 6: Land Use and Section 3, Part 8: Pedestrians, Cyclists, Equestrians and Community Effects.

7.6.7.3 Potential effects will be described and the assessment will include consideration of potential cumulative effects as appropriate. Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts. The significance of residual effects remaining after implementation of proposed mitigation measures will be presented.

7.6.8 Scoping Questions for Consultees

7.6.8.1 Scoping questions primarily for ERYC in relation to assessment of land use and agriculture include the following.

- Do you agree that the data sources identified are sufficient to inform the land use and agriculture baseline for the Hornsea Four EIA?
- Is there any other baseline information that should be considered as part of the assessment?
- Do you agree with the proposed approach to assessment (scoped in or out, and detailed or simple assessment) for each of the impacts in **Table 7-20**?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of Hornsea Four on land use and agricultural resources?

7.7 Traffic and Transport

7.7.1 Introduction

7.7.1.1 This section of the Scoping Report considers the traffic and transport interests of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and, where relevant, decommissioning activities (i.e. landward of MHWS) of Hornsea Four. During operation, the onshore project components will generate limited

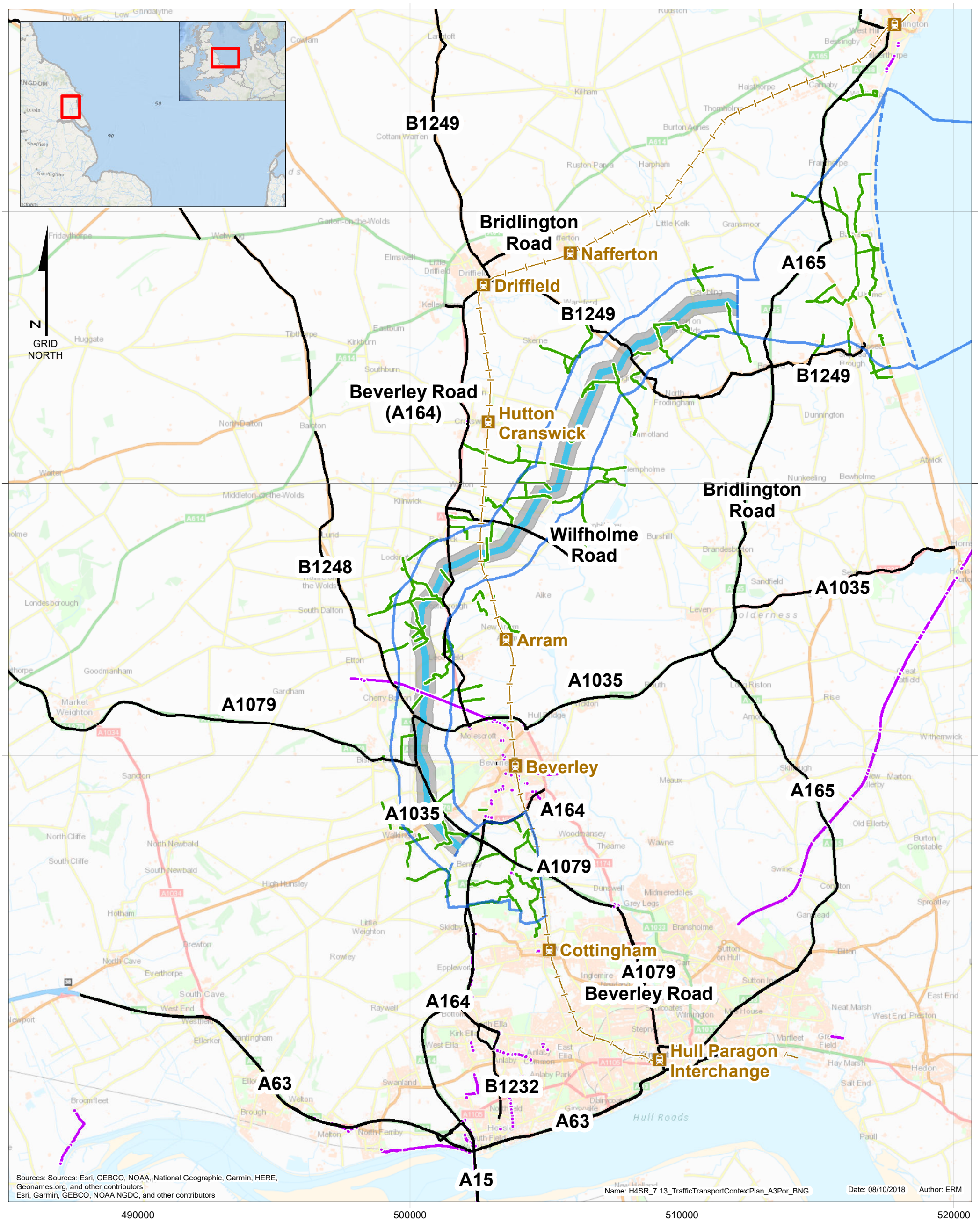
traffic and will not materially change traffic and transport patterns. The potential for likely significant effects is therefore largely limited to the construction phase.

7.7.1.2 The construction phase traffic and transport impact is split into the following three key elements:

- construction traffic associated with constructing the onshore cable route;
- construction traffic associated with the construction of the onshore substation; and
- abnormal loads associated with the delivery of transformers and shunts to the onshore substation.

7.7.2 Study Area

7.7.2.1 The traffic and transport general study area considers the Strategic Road Network (SRN) and other linkages that may be affected by construction traffic from Hornsea Four. As the construction traffic routing for Hornsea Four has not yet been defined, the scoping assessment assumes that the main points of connection will be via the A63 due west of Hull and an appropriate deep-water port. Key transport infrastructure within the general study area is shown on **Figure 7-13**.



Scoping Boundary
Scoping Boundary Component
Indicative Permanent Cable Area
Indicative Temporary Works
Station
Road
Railway
Cycleways (Department for Transport)
Public Rights of Way (East Riding of Yorkshire Council)

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:130000

0 1 2 3 4 Kilometres
0 1 2 4 Miles

Hornsea Four

Traffic and Transport Context Plan

Figure: 7.13

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7.7.2.2 Each of the three key transport issues identified in Section 7.7.1 will have a specific study area that will be refined as the EIA progresses and the cable route and sub-station locations are defined. At this scoping stage, it is assumed this will comprise:

- Onshore cable study area – the indicative temporary works area within the Onshore ECC; locations at which the construction traffic will access the haul road sections; locations where the cable route will cross or affect an existing transport feature (i.e. a road or PRoW); and areas of the local transport network (or receptors thereon) remote from the export cable route which may be affected by construction traffic.
- Onshore substation construction traffic study area – this includes the onshore substation search area and locations such as roads, cycleways, footways, and noise/vibration sensitive receptors (schools/sheltered housing) which may be affected by substation construction traffic.
- Abnormal loads study area – the SRN, highway network and its users which may be affected by the transport of abnormal indivisible loads travelling from the arrival deep-water port and the onshore substation.

7.7.3 Baseline Environment

Data Sources used for Scoping

7.7.3.1 A desk study was undertaken to obtain information on traffic and transport infrastructure within the general study area. The following data sources of information were consulted.

Source	Summary	Coverage of Hornsea Four development area
Ordnance Survey	Mapping indicating the locations of potential key road links..	Full coverage of the Hornsea Four onshore scoping boundary.
Department for Transport	Annual Average Daily Traffic Flow of key road links and cycleways.	Key road links and cycleways data in the general study area and including the scoping boundary.
East Riding of Yorkshire Council	Public Rights of Way.	Full coverage of the Hornsea Four onshore scoping boundary.

Overview of Baseline Environment

7.7.3.2 The scoping boundary shows the approximate landfall location (to the south of Bridlington) and onshore ECC in a south-westerly orientation to a point due north of Beverley, where it turns to a more southerly direction and passes to the west of the town of Beverley. The corridor then loops round to the south of Beverley to show the scoping boundary terminating at an approximate substation location close to Creyke Beck.

7.7.3.3 The scoping boundary by intent avoids most major towns and villages but is expected to pass close to the settlements of Leconfield and Walkington. Other villages may be in scope depending on the final temporary works area of the onshore ECC.

7.7.3.4 **Table 7-21** identifies the key transport infrastructure in the study area and the baseline traffic flow on each route. A number of PRoW and cycleways are also present within the scoping boundary as shown on **Figure 7-13**.

Table 7-21 Traffic Flow Data on Key Links (Source: DfT, 2018)

Route	Annual Average Daily Traffic Flow (Year of Data)
A165 Bridlington Road	11572 (2017)
B1249	2972 (2009)
A164 Beverley Road	9550 (2017)
Wilfhome Road	No data available
B1248	6099 (2009)
A1035	14021 (2017)
A1079	19422 (2017)
A164	31215 (2017)

7.7.4 Project Basis for Scoping Assessment

7.7.4.1 The traffic and transport scoping assessment is based on the following.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.
- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.
- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.
- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the

onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.

- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.
- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.
- Traffic and transport infrastructure could be directly affected by construction works within the temporary project footprint defined by the substation search area, the landfall search area and the 700 m indicative temporary works area and 200 m indicative permanent cable area of the ECC respectively. The locations and extents of activities will be refined as route planning and site selection and design progress allowing avoidance in some instances and development of other solutions (e.g. HDD crossing of roads) elsewhere.
- The construction activities outlined in Chapter 3 Project Description will generate traffic movements on the SRN and local roads, including abnormal loads.
- Maintenance activities will generate limited traffic and the operation of the substation and energy balancing facility will have no material residual transport effect on the surrounding network.

7.7.4.2 It is assumed that some of the onshore project components are likely to be transported from the Trunk Road Network (via the A63), which also provides the major connection to the Port of Hull, Hull City Centre and the South Bank of the Humber. The abnormal load route from the SRN is likely to be via the A63 and A164. The routeing of substation construction traffic will be defined in more detail as the EIA progresses.

7.7.4.3 All offshore project components are assumed to be fabricated off-site, stored at a suitable port facility and transported directly offshore as needed.

7.7.5 Embedded Mitigation

7.7.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on traffic and the transport network (see **Table 7-22**). These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

7.7.5.2 As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section**

7.7.6 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 7-22– Relevant Traffic and Transport Commitments

ID	Measure Proposed	How the measure will be secured
Co1	Primary: All natural watercourses including main rivers and ordinary watercourses (not artificial drainage ditches, flood defences), main roads and railways will be crossed by HDD or other trenchless technology where technically practical.	CoCP and DCO requirement
Co2	Primary: Where practical the following sensitive sites will be avoided by the permanent project footprint: SSSI Units, Ancient woodland, areas of consented development, areas of historic landfill and other known areas of potential contamination, RSPB reserves, Local Nature Reserves, Local Wildlife Sites, Yorkshire Wildlife Trust Sites, National Trust Land, Listing Buildings and Scheduled Monuments. Where possible, unprotected areas of woodland, mature and protected trees (those with TPOs) shall also be avoided.	DCO Works Plans and Order limits
Co79	Tertiary: Signage and/or temporary PRoWs/footpath diversions will be provided during construction.	CoCP and DCO requirement
Co80	Primary: A crossing schedule is provided which includes crossing methodology for each crossing of road, rail, PRoW and watercourse.	DCO requirement
Co124	Tertiary: Adoption of an agreed Construction Code of Practice to minimise temporary disturbance to residential properties, recreational users, and existing land users.	CoCP and DCO requirement
Co127	Tertiary: A Decommissioning Plan or method statement will be agreed with the removal of all onshore above ground infrastructure.	DCO requirement

7.7.6 Likely Significant Effects

7.7.6.1 Table 7-23 sets out an assessment of effects on traffic and transport at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.7.6.2 The assessment presented in Table 7-23 is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in Table 7-22, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for traffic and transport effects; relevant policy; the assessment criteria provided in Annex C; the question-led approach set out in Section 1.7; and the professional judgement of qualified traffic experts.

7.7.6.3 Table 7-23 is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or

detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.7.6.4 Broadly a detailed assessment will be fully quantitative using project collected data and surveys to determine the level of effect and a simple assessment will be mainly qualitative using network observations and other existing baseline information to inform the simple assessment to an agreed methodology/approach.

7.7.6.5 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 7-23 Likely Effects – Traffic and Transport

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage	Proposed Approach to Assessment	Further Baseline Data Requirements
Impact from transport of offshore project components on the road network: Construction Phase Pre-fabricated off-shore construction elements (wind turbines/foundations etc.) could affect traffic if transported by road	All offshore project components are assumed to be fabricated off-site, stored at a suitable port facility and transported directly offshore as needed.	Negligible	Low	**No likely significant effects**	**Scoped out**	N/A
Impact on Driver Delay on regionally, nationally or internationally significant roads: Construction Phase Additional construction traffic may influence driver delay.	Primary: Co1	Small	High	**Likely significant effect without secondary mitigation** Effects on the SRN due to construction traffic	Scoped in. A detailed, fully quantitative assessment will be undertaken using project collected data and surveys to determine the level of effect.	Traffic flow data for in-scope roads and junctions
Impact on Driver Delay on locally significant roads: Construction Phase Additional construction traffic may influence driver delay.	Primary: Co1	Medium	Medium	**Likely significant effect without secondary mitigation** Construction traffic movements on the A164 and other key roads in the County	Scoped in. A detailed, fully quantitative assessment will be undertaken using project collected data and surveys to determine the level of effect.	Traffic flow data for in-scope roads and junctions
Impact on Driver Delay on local roads and past locally sensitive receptors: Construction Phase Additional construction traffic may influence driver delay and affect sensitive receptors	Primary: Co1	Large	Low	**Likely significant effect without secondary mitigation** Construction traffic movements on the A164 and other key roads in the County	Scoped in. A simple qualitative assessment will be undertaken using network observations and other existing baseline information.	Traffic flow data for in-scope roads and junctions
Impact on Driver Delay on very minor local roads, parts of roads or uni-	Primary: Co1	Large	Negligible	**No likely significant effect**	**Scoped out**	N/A

directional impact: Construction Phase Additional construction traffic may influence driver delay						
Severance: Construction Phase The temporary impact of the construction work may affect severance of routes/cause severance.	Primary: Co2	Small	Low	No likely significant effect	**Scoped Out**	
Pedestrian delay and amenity: Construction Phase The temporary impact of the construction work may affect pedestrian delay and amenity	Tertiary: Co79 Primary: Co80	Small	Medium	**Likely significant effect without secondary mitigation**. Impact will reduce amenity of users and may increase delay slightly. PRoWs typically not used by large numbers but are well protected by legislation/acts of parliament	Scoped in. A simple assessment will be undertaken. This is likely to be the identification of all in-scope footways and PRoWs that are crossed or affected by the construction works and the identification of safe methods of working in a CoCP.	PRoW (definitive) map
Accidents and Road Safety: Construction Phase The temporary impact of the construction work may affect accidents and road safety.	Tertiary: Co124	Large	High	**Likely significant effect without secondary mitigation**. Serious injury or death could result. Particularly at access points where vehicle conflicts occur and risk levels are high. The sensitivity increases if vulnerable road users are present	Scoped in. A detailed assessment will be undertaken including collision analysis of all parts of the road network significantly affected by the construction works and traffic engineering input to ensure that permanent and temporary construction access points meet modern design standards and provide evidence that these can be trafficked safely.	Accident data for temporary and permanent access point locations. Topographic data or mapping tiles to design a safe road layout

Hazardous and Abnormal Loads: Construction Phase The temporary impact of hazardous, dangerous and abnormal loads during construction works.		Large	High	**Likely significant effect without secondary mitigation.** Transformers likely to be massively abnormal in every dimension. Potential damage to highway structures. Risk to other road users during the move. Specialist vehicles required. Route also uses SRN adjacent to the Port and Humber Bridge – nationally important piece of the network	Scoped in. A detailed assessment will be undertaken including a full review of the abnormal load route from the SRN for critical structure dimensions/capability. Swept path analysis of key junctions, bends and other constraints on the route.	Bogie bolster/vehicle dimensions/details Mapping tiles for swept path analysis Highway structure data Chosen transformer details
Impacts from traffic generation: Operation Potential traffic impacts arising from the operation and maintenance of the onshore elements		Negligible	Low	**No Likely significant effect**	**Scoped out**	
Impacts from traffic generation: Decommissioning The temporary impact of the decommissioning work may affect driver delay, safety and other elements of the network	Tertiary: Co127	Varied	Varied	**No likely significant effect**	**Scoped out**	
Impact of Hornsea Four on Planned Changes in the Network: Construction Phase		Small	Low	**Likely significant effect without secondary mitigation.** Large construction project nearby on A164 and surrounds with similar timeframe. Impact on construction traffic; routing; TM etc. Could be construction benefits/savings from joined up working.	Scoped in. A simple qualitative assessment will be undertaken of the various schemes and identification of overlaps and potential points of interface.	Establish an interface to the ERYC A164 improvement team and A63 Castle Street, Hull (c/o Highways England)

7.7.7 Impacts Scoped Out of Assessment

Impact from transport of offshore project components on the road network: Construction Phase

7.7.7.1 All offshore project components (wind turbines/foundations etc.) are assumed to be fabricated off-site, stored at a suitable port facility and transported directly offshore as needed and so will have limited impact on the road network.

Impact on Driver Delay on very minor local roads, parts of roads or uni-directional impact: Construction Phase

7.7.7.2 The impact on very minor local roads is not expected to be significant. Even where the magnitude of effect is expected to be large, (e.g. in terms of a percentage increase over baseline traffic levels) the receptor value is negligible such that the resulting effect is not significant. No assessment is required for this impact on very minor local roads.

Severance: Construction Phase

7.7.7.3 Severance is only likely to occur on highly trafficked roads and result from the perceived division the road and traffic creates between communities on either side. IEMA guidance (IEMA, 1993) identifies that increases in total traffic volumes of between 30 % and 60 % could result in a slight impact (the lowest category) upon severance. Hornsea Project Three ES (Ørsted, 2017), which generated changes in traffic flows of less than 30%, concluded that there would negligible severance effect as a result of the project. Hornsea Four will be similar in nature to Hornsea Project Three and will not generate significant severance impacts.

Impacts from traffic generation: Operation

7.7.7.4 The daily trip generation associated with the operation will be insignificant on the network. The operation and maintenance base for the offshore elements is expected to be at or near to a Port so will have limited impact on the road network. Onshore operation and maintenance activities are expected to generate, at maximum, a handful (around a half a dozen) of technicians attending the sub-station or cable route on any particular day.

Impacts from traffic generation: Decommissioning

7.7.7.5 Decommissioning is expected to involve some similar transport activities to the construction process, however more material (including the onshore cable) will be abandoned in-situ and basic building materials will likely be recycled on-site rather than transported off-site or over large distances. Experience suggests that large transformers (associated with the onshore substation) will also be recycled on-site, with valuable materials salvaged and transported on conventional vehicles. Decommissioning is not expected to generate significant effects on traffic and transport.

7.7.8 Proposed Approach to the PEIR and ES

7.7.8.1 Table 7-23 has identified several likely significant effects which will require assessment, additional primary and secondary baseline data collection and the development of suitable secondary mitigation. The volume of traffic generated by Hornsea Four in relation to threshold values stated within (IEA, 1993) will be assessed. A route assessment will also identify any key receptors or physical highway constraints along the proposed route of the transformers and within the study area of the construction traffic.

7.7.8.2 ERYC (the Local Highway Authority), and Highways England (the Strategic Highway Authority) will be consulted to accurately define the traffic and transport study area and the extent of any traffic survey data required for the EIA. The approach to collection of traffic flow data on roads and junctions in the scope of the detailed assessment will be agreed. This is likely to be in the form of Automatic Traffic Counters on key links/crossings and junction turn counts at key junctions of where new or temporary junction are formed. Personal Injury collision data will also be extracted from ERYC's database at key points. Data are planned to be collected in autumn to winter 2018 outside of school holidarys.

7.7.8.3 The Traffic and Transportation section of the PEIR will:

- establish baseline conditions;
- include consultation with key stakeholders ERYC (the Local Highway Authority), and Highways England (the Strategic Highway Authority);
- quantify and analyse the distribution of construction traffic (including HGVs; plant and site personnel transport) on the existing local highway network;
- include swept path analysis and basic assessment of abnormal load route(s) as needed;
- input to the design of access junctions to cable route haul road sections;
- outline design of onshore substation access junction (including swept path analysis);
- assess capacity and safety of the local road network during construction;
- assess the impact on public transport during construction;
- assess the impact on PRoW and non-designated access routes during construction and the need to close or divert paths crossed by the cable route;
- assess the impact of Hornsea Four on sensitive receptors including schools and non-motorised users including users of paths and cycleways;
- assess the potential impacts against key network operational criteria including: traffic flow; road safety; severance; noise; driver delay; pedestrian and cyclist delay; fear and intimidation; air quality and dust and dirt deposits;
- consider committed development and the impact of committed schemes and network changes; and
- identify appropriate mitigation measures.

7.7.8.4 The significance of effects will be determined using standard impact assessment methods and criteria as presented in Annex C, which are based on IEA (1993) and Highways Agency et al (2008). The assessment will take into account the magnitude (size, scale, geographic

extent, duration, reversibility) of the impact and the sensitivity (suceptability and value) of affected receptors to a particular impact. Potential effects will be described.

7.7.8.5 Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts. The significance of residual effects remaining after implementation of proposed secondary mitigation measures will be presented.

7.7.8.6 The assessment will include consideration of potential cumulative effects as appropriate.

7.7.9 Scoping Questions for Consultees

7.7.9.1 ERYC (the Local Highways Authority) and Highways England (the Strategic Highways Authority) are asked to consider the following questions:

1. What is ERYC's view on extent and details of in-scope road network?
2. What is ERYC's view on any significant sensitive receptors?
3. Does ERYC agree with the proposed method of baseline data collection?
4. Can the following data and information be provided please:
    - Can ERYC make available traffic flow data on in-scope roads and junctions – as defined in **Table 7-21**?
    - Can ERYC make available collision data on in-scope roads and junctions?
    - Can the Definitive PRoW map be provided?
    - Can Topographical or highway boundary data be provided at temporary access point locations?
    - Can the abnormal load details/process and initial thoughts on routing (also to SHA – Highways England) be provided?
    - Can the abnormal load structures details (also to SHA – Highways England) be provided?
    - Can a list of committed developments be provided?
    - Can a list of planned schemes/network changes be provided?
    - Can design and contact details of A164 dualling scheme be provided?
    - Can design and contact details be provided for the A63 Castle Street Scheme?

7.8 Noise and Vibration

7.8.1 Introduction

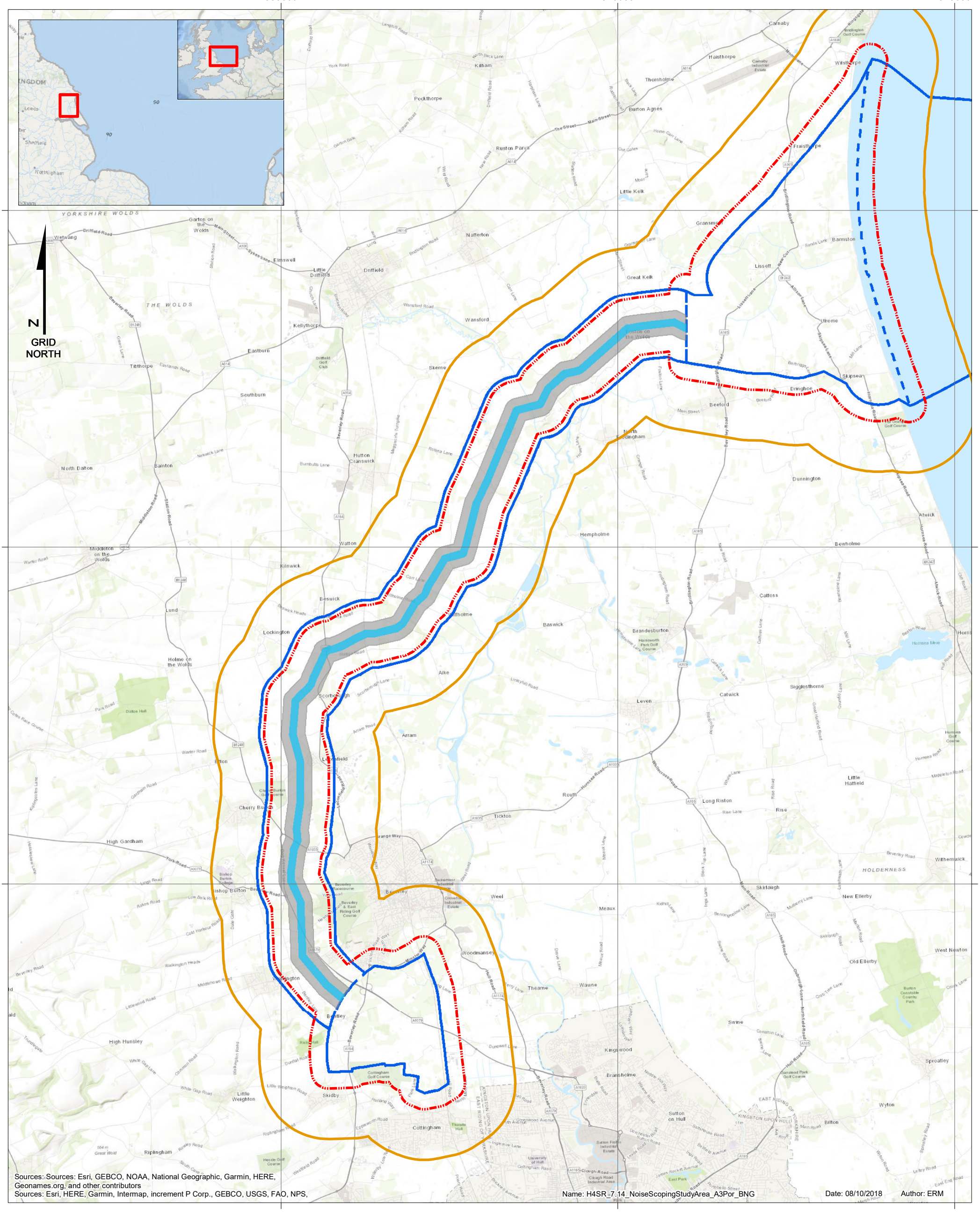
7.8.1.1 This section of the Scoping Report considers the potential noise and vibration effects from construction, operation (including maintenance) and, where relevant, decommissioning activities of the onshore elements of Hornsea Four. The potential for likely significant effects is limited to noise emissions from the construction and operation of the onshore substation, construction works (including HDD) at the landfall and along the indicative temporary works area of the cable. Noise from construction traffic is also considered.

7.8.1.2 This section of the Scoping Report considers the potential onshore noise and vibration effects. Noise and vibration effects seaward of MHWS are addressed in **Chapter 6** Environmental Topics and Potential Effects Offshore.

7.8.2 Study Area

7.8.2.1 For construction, the study area for the onshore substation is a 500 m buffer around the substation search area. Significant noise and vibration effects are not expected beyond this distance. For operation, where night-time noise effects from the substation are possible, the study area encompasses a 2 km area to reflect people's increased sensitivity to noise at night. A 2 km study area has also been applied from the edge of the landfall and indicative temporary works area. This allows for consideration of construction activities from the cable (where HDD works may be required).

7.8.2.2 The study area distances are shown in **Figure 7-14**. The study area will be reviewed and amended as the onshore ECC is refined and substation site selected.



Scoping Boundary

Scoping Boundary Component

Indicative Permanent Cable Area

Indicative Temporary Works

Indicative 500m Study

2km Noise Buffer of Landfall, Indicative Temporary Works and Substation Search Area

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres

0 1 2 3 4 Miles

Hornsea Four

Noise and Vibration Scoping Study Area

Figure: 7.14

Document no: H4SR_7.14
Created by: AA
Checked by: JW
Approved by: NL

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7.8.3 Baseline Environment

7.8.3.1 The baseline environment within the study area is mainly rural with occasional residential properties.

7.8.3.2 A desk based review and consultation will be undertaken to identify potentially sensitive receptors. Background noise monitoring will be undertaken at residential properties where the potential for significant noise effects from the onshore substation is identified, and where needed to inform the construction assessment. Any surveys will be agreed in consultation with ERYC and will be carried out for a sufficient period to allow typical sound levels to be established, taking account of different types of noise sources and weather conditions that occur. Noise surveys may be accompanied by the acquisition of supplementary non-acoustic data (rainfall and wind records), as required.

7.8.4 Project Basis for Scoping Assessment

7.8.4.1 The following assumptions have been made in relation to the noise and vibration scoping assessment.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.
- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.
- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.
- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.
- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.

- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.

- Noise sensitive receptors could be exposed to construction noise that is generated within the temporary and permanent project footprint defined by the substation search area, the landfall search area and the 700 m indicative temporary works area of the ECC. The locations and extents of activities will be refined as route planning and site selection and design progress allowing potential noise levels at receptors to be minimised or reduced.

- Night working is not expected to be required for construction and decommissioning of the onshore substation (unless in exceptional circumstances).

- The only material source of operation noise will from the onshore substation.

7.8.4.2 The basis for assessment also includes the embedded mitigation where appropriate.

7.8.5 Embedded Mitigation

7.8.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on noise and vibration (see **Table 7-24**). Some of these measures (Co 133 and Co 135) include distances beyond which construction noise levels are unlikely to be significant, based on scoping predictions using the BS 5228 method (see **section 7.8.6**). The embedded mitigation measures will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in **Annex A**.

7.8.5.2 As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in **section 7.8.6** (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 7-24 Relevant Noise and Vibration Commitments

ID	Measure Proposed	How the measure will be secured
Co36	Core working hours for the construction of the onshore elements of Hornsea Four are as follows: • Monday to Friday: 07:00 - 18:00 hours; • Saturday: 07:00 - 13:00 hours; • Up to one hour before and after core working hours for mobilisation ("mobilisation period"), i.e. 06:00 to 19:00 weekdays and 06:00 to 14:00 Saturdays; and	DCO requirement CoCP Works Plans and Order Limits

ID	Measure Proposed	How the measure will be secured
	• Maintenance period 13:00 to 17:00 Saturdays. Activities carried out during mobilisation and maintenance will not generate significant noise levels (such as piling, or other such noisy activities). In certain circumstances, specific works may have to be undertaken outside the normal working hours - such as: • Horizontal Directional Drilling (HDD) or other trenchless construction operations which may require 24 hour machinery operation, dependent on the ground conditions; • Remedial works, for example in the event of severe weather; • Delivery of electrical infrastructure; • Jointing operations along the cable route; and • Security of sites and protection of open assets.	
Co41	Primary. All trenchless crossings will be undertaken by non-impact methods and, as such, construction vibration would be unlikely to be significant beyond the immediate location of works. No blasting is anticipated.	CoCP and DCO requirement
Co123	Tertiary. Based on noise modelling results, where noise has the potential to cause disturbance the use of mufflers, acoustic barriers and directional lighting for areas where HDD is undertaken.	CoCP and DCO requirement
Co133	Primary. The onshore ECC will be routed to avoid noise sensitive properties by at least 50 m.	Works Plans and Order Limits
Co134	Primary. Cable installation works at the landfall area will be located at least 200 m from noise sensitive properties.	Works Plans and Order Limits
Co135	Primary. Construction access roads along the onshore ECC will be located at least 150 m from noise sensitive properties.	Works Plans and Order Limits
Co137	Tertiary. Vehicle movements associated with operation and planned maintenance of the onshore infrastructure will operate only during the daytime and evening periods (i.e. 0700 – 2300). Vehicle movements may however be subject to unscheduled events outside of these hours.	DCO requirement

7.8.6 Likely Significant Effects

7.8.6.1 Table 7-25 sets out an assessment of effects of noise and vibration at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.8.6.2 The assessment presented in **Table 7-25** is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in **Table 7-24**, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for noise and vibration effects; relevant policy; the assessment criteria provided in **Annex C**; the question-led approach set out in **Section 1.7**; and the professional judgement of qualified noise experts.

7.8.6.3 Scoping predictions have been carried out in some cases to support proposals on scoping a matter out. Such predictions have been used to calculate the distance beyond which construction noise levels are predicted to fall below the daytime construction criteria of 65dB, LAeq,12h (using the ABC method set out in BS 5228 and assuming a low background noise level, which is a worst case approach). The following noise levels have been assumed, based on source noise levels from the database provided in BS 5228 and on previous experience of the number and type of construction equipment likely to be required for the various construction activities; Lw 106 dB(A) for cable route construction, Lw 114 dB(A) for access road construction. The prediction method set out in BS 5228 has been followed, conservatively igoring any screening from topography or intervening structures.

7.8.6.4 **Table 7-25** is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

- A simple assessment will make use of conservative simplifications of the data inputs and / or the calculation method, for example, a spreadsheet calculation which does not take account of attenuation from the screening effects of ground topography as opposed to 3D modelling software. This reduces the time required to carry out the assessment but is more likely to overestimate adverse effects.
- A detailed assessment will be carried out where necessary using data inputs and / or a calculation method which results in a higher level of certainty.

7.8.6.5 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 7-25 Likely Effects – Noise and Vibration

Project Activity and Potential Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage	Proposed Approach to Assessment	Further Baseline Data Requirements
Noise and vibration: Construction phase Indicative temporary works area - temporary noise and vibration from onshore cable installation (excluding HDD works)	Primary Co36 Co41 Co133	Small	High	**No likely significant effect**	**Scoped out**	N/A
Noise and vibration: Construction phase Indicative temporary works area - temporary noise and vibration from HDD works and other trenchless technologies	Primary Co36 Co41 Co134	Small - Large	High	**Likely significant effect without secondary mitigation** HDD will only be required in certain circumstances (e.g. road, rail or river crossings). Depending on the size of equipment required for each crossing, NSRs may experience significant effects, however these will normally be relatively brief. Should HDD be required at night, impacts may be greater.	Scoped in. A detailed assessment will be undertaken using data inputs and / or a calculation method	In some cases, baseline noise monitoring may be required to better understand the significance of potential noise effects.
Noise and vibration: Construction phase	Co134	Small - Large	High	**Likely significant effect without secondary mitigation**	Scoped in. Detailed assessment	Baseline noise monitoring may be required to better

Landfall, nearshore and intertidal area - temporary noise and vibration from cable installation works				Subject to the proximity of receptors to the works.	using data inputs and / or a calculation method	understand the significance of potential noise effects subject to the proximity of this activity to receptors and its likely duration.
Noise and vibration: Construction phase Temporary noise and vibration from constructing the jointing bays	Primary Co36	Small - Large	High	**Likely significant effect without secondary mitigation.** Noise effects dependent on proximity to NSRs.	Scoped in. A simple assessment e.g. a spreadsheet calculation will be undertaken.	N/A
Noise and vibration: Construction phase Temporary noise and vibration from constructing the haul road access points	Primary Co36 Co41 Co135	Small	High	**Likely significant effect without secondary mitigation** Construction access roads will be located at least 150 m from noise sensitive properties. At this distance noise levels are predicted to be below the construction criteria.	**Scoped out**	N/A
Noise and vibration: Construction phase Temporary noise and vibration from construction of the onshore substation. Includes the temporary impacts of tubular steel piling (percussive piling)	Primary Co36	Small - Large	High	**Likely significant effect without secondary mitigation.** Subject to the proximity of receptors to the selected substation site and/or without secondary mitigation in place	Scoped in. A detailed assessment will be undertaken using data inputs and / or a calculation method if percussive	N/A

					piling is proposed.	
Traffic noise: Construction Phase	Primary Co36	Small - Large	High	**Likely significant effect without secondary mitigation.** Subject to the anticipated volumes of traffic and/or without secondary mitigation in place	Scoped in. A simple assessment e.g. a spreadsheet calculation will be undertaken.	Existing traffic flow data for the construction traffic route.
Noise from the onshore substation: Operation		Small - Large	High	**Likely significant effect without secondary mitigation.** Noise effects dependent on design, layout and proximity to NSRs.	Scoped in. A detailed assessment using data inputs and / or a calculation method will be undertaken.	Where the potential for significant noise effects is identified background noise monitoring will be undertaken at residential properties close to the onshore substation.
Noise from buried cable: Operation		No Change	High	**No likely significant effect**.	**Scoped out**	N/A
Operational Traffic Noise: Operation	Tertiary Co137	Negligible	High	**No likely significant effect**.	**Scoped out**	N/A
Noise and vibration from routine maintenance activities: Operation		Negligible	High	**No likely significant effect**.	**Scoped out**	N/A
Vibration: Operation		Negligible	High	**No likely significant effect**.	**Scoped out**	N/A
Noise from operation of the offshore HVAC booster: Operation	The offshore HVAC booster will be located at least 20 km from shore.	Negligible	High	**No likely significant effect**.	**Scoped out**	N/A
Decommissioning Temporary noise and	Primary Co36	Negligible	High	**No likely significant effect**.	**Scoped out**	N/A

vibration from plant along the cable route						
Decommissioning Temporary noise and vibration from plant at the onshore substation	Primary Co36	Small - Large	High	**Likely significant effect without secondary mitigation**. Impacts are likely to be no higher than for construction.	Scoped in. A simple assessment e.g. a spreadsheet calculation will be undertaken.	N/A

7.8.7 Impacts Scoped Out of Assessment

7.8.7.1 Table 7-25 proposes to scope a number of potential effects out from further assessment in the PEIR or ES. These scoping judgements have, in some cases, been based on scoping prediction calculations as described in section 7.8.4. The following sections describe the impact pathways that are proposed to be scoped out from assessment.

7.8.7.2 Indicative temporary works area - temporary noise and vibration impacts from onshore cable installation (excluding HDD works)

7.8.7.3 Based on the Hornsea Project Three ES (Ørsted, 2017), during construction, small numbers of relatively small scale earth moving equipment could be in the vicinity of individual noise sensitive receptors at any one time. Noise levels are predicted to be below the construction criteria at receptors in excess of 55 m from the indicative temporary works area. The onshore ECC will be routed to avoid noise sensitive properties by at least 50 m. Between 50 and 55 m, some activities may result in noise levels above the criteria, however, for a brief period only as each activity will progress quickly. Vibration levels from this construction activity are expected to be low and not significant.

Temporary noise and vibration from construction of haul road accesses

7.8.7.4 Construction access roads along the onshore ECC will be located at least 150 m from noise sensitive properties. At this distance noise levels are predicted to be below the construction criteria.

Operational noise from buried cables, traffic movements, routine maintenance activities and operational vibration from the onshore substation

7.8.7.5 Sensitive receptors are not expected to be significantly affected by operational noise from buried cables, traffic movements or maintenance activities. The cable and other components include no moving parts or other significant noise generating mechanisms. Operational traffic flows are expected to be minimal and will be planned and will avoid the night time period where possible. Maintenance activities (e.g. repairs and inspections of the cables) are likely to be infrequent, temporary and therefore not significant. The operational substation equipment is not expected to generate noticeable levels of vibration.

Noise from operation of the offshore HVAC booster

7.8.7.6 The offshore HVAC booster will be located at least 20 km from shore. At this distance, significant noise effects on onshore receptors are not expected.

Temporary noise and vibration from plant used during decommissioning of cables

7.8.7.7 The export cables will be left in place in the ground with the cable ends cut. Jointing bays may also be left in place. If removed, any noise effects will be brief and during the daytime at each site, and so will not significantly affect sensitive receptors.

7.8.8 Proposed Approach to the PEIR and ES

7.8.8.1 Table 7-25 has identified several likely significant effects on noise and vibration sensitive receptors that will require assessment, additional baseline measurements of noise and possibly the development of suitable secondary mitigation. Notably, there will be detailed assessment of construction noise arising from HDD works (and other trenchless technologies) and percussive piling (if required) at the onshore substation. Operational noise effects from the onshore substation will also be considered in detail. The other elements scoped-in will be subject to simple assessment, e.g. by spreadsheet calculation.

7.8.8.2 The assessment will be informed by a combination of desk based assessment and field based survey, including noise monitoring of the baseline (planned in autumn/winter 2018). Consultation will be held with relevant statutory and non-statutory organisations, including ERYC Environmental Health department, throughout the process.

7.8.8.3 It is important to note that the need for further noise assessment will be influenced by on-going route planning and siting decisions and the ultimate proximity of the various noise-generting project activities to noise sensitive receptors. One objective of route planning and site selection is to avoid noise sensitive receptors by various margins (for example, the onshore ECC will be routed to avoid noise sensitive properties by at least 50 m), and it is anticipated this will reduce the eventual scope of the noise assessment required since some impacts will simply be avoided.

7.8.8.4 The significance of effects will be determined using standard impact assessment methods and criteria such as those provided in Annex C which draw from BS 5228-1 (British Standards Institution, 2014), BS 5228-2 (British Standards Institution, 2014), BS 4142 (British Standards Institution, 2014) and Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7 (Highways England, 2011). Where criteria are exceeded, the assessment will take into account the magnitude and duration of the impact and the sensitivity of affected receptors to a particular impact.

7.8.8.5 Secondary mitigation measures will be presented to avoid, minimise or reduce adverse impacts. The significance of residual effects remaining after implementation of proposed mitigation measures will be presented.

7.8.8.6 The assessment will include consideration of potential cumulative effects as appropriate.

7.8.9 Scoping Questions for Consultees

7.8.9.1 EYRC is asked to consider the following questions:

1. Do you agree that all potentially significant sources of noise and vibration from Hornsea Four activities have been identified?
2. Do you agree that appropriate standards and methods of assessment are proposed based on the potential for noise impact?
3. Do you agree with the proposal to scope out the following:
   - temporary noise and vibration from installation of the onshore cable (excluding HDD crossings);
   - temporary noise and vibration from constructing the construction road accesses;
   - operational noise from buried cable;
   - vibration during the operational phase;
   - increase in noise from vehicle movements associated with the operation and maintenance of the onshore infrastructure;
   - noise and vibration from routine maintenance activities associated with the onshore substation;
   - temporary noise and vibration from plant used during decommissioning;
   - noise from operation of the offshore HVAC booster?

7.9 Air Quality and Health

7.9.1 Introduction

7.9.1.1 This section of the Scoping Report considers the potential impacts on ambient air quality from construction, operation (including maintenance) and, where relevant, decommissioning activities) of the onshore elements of Hornsea Four. Impacts on air quality could lead to consequent effects on human health and amenity. Due to the nature of Hornsea Four the potential for significant effects due to impacts on air quality is effectively limited to the construction phase. The principal impacts of interest are associated with dust and particulate matter (as PM_{10}), due to construction activities and nitrogen dioxide (NO_2) from construction traffic.

7.9.2 Study Area

7.9.2.1 In general air quality impacts will be limited to a maximum of 500 m from any construction activities as this is the maximum distance downwind that dust will travel as a precautionary approach and 200 m from access routes (impacts from locally released exhaust emissions tend to be negligible at greater distances than this from road sources, DMRB). The study area for the scoping assessment is therefore generally a 500 m buffer around the 700 m indicative temporary works area and 200 m around access routes.

7.9.3 Baseline Environment

Baseline Overview

7.9.3.1 A desk study was undertaken to obtain a high-level understanding of the current air quality in the study area, and to determine if any Air Quality Management Areas (AQMAs) are within or adjacent to the study area. AQMAs are locations where air quality standards are not currently achieved and attract more scrutiny with regards to additional impacts. DEFRA's online interactive map (DEFRA, 2018) shows there are no AQMAs declared within or adjacent to the study area and the main access routes for construction. The nearest AQMA is in southwest Hull city centre adjacent to the Humber Estuary.

7.9.3.2 A review was undertaken to identify whether any ambient air quality monitoring data were available to determine the air quality baseline. DEFRA's online interactive monitoring networks map (DEFRA, 2018) shows there are no AURN (Automatic Urban and Rural Network) monitoring stations operating within or adjacent to the study area. Furthermore, there are no local authority air quality monitoring stations in the vicinity (<5 km) of the project.

7.9.3.3 As there are no monitoring data available, baseline information was obtained from DEFRA background mapping (Ref. 3). This shows that current (2015) background concentrations in and adjacent to the study area are:

- below 17 µg/m^3 for annual mean PM_{10}, Air Quality Standard 40µg/m^3;
- below 20 µg/m^3 for annual mean NO_2, Air Quality Standard 40µg/m^3; and
- below 20 µg/m^3 for annual mean NO_x, Air Quality Standard (protection of vegetation) 30µg/m^3.

7.9.3.4 The existing baseline is well below the Air Quality Standards which is as expected for this kind of environment (rural/suburban) in the UK.

Summary and Key Issues

7.9.3.5 The onshore project components will be located in mainly rural and some suburban areas, which has a double advantage with regards to air quality: the number of sensitive receptors is limited; and air quality is not constrained with regards to concentrations of PM_{10}, NO_2 and NO_x pollution. No AQMAs have been identified within or adjacent to the study area and the main access routes for construction.

7.9.4 Project Basis for Scoping Assessment

7.9.4.1 Impacts on air quality have the potential to arise during the construction phase. This is due to emissions of dust and PM_{10} from construction activities, including earthworks, construction and trackout onto local roads; and due to exhaust emissions from

construction traffic generated on nearby roads. No impacts on air quality are anticipated to arise during the operation phase.

7.9.4.2 The air quality scoping assessment is based on the following.

- The landfall will be achieved by eight HDD crossings (one per HVAC circuit and two spare) at a location within the landfall search area. Each circuit will have a transition joint bay.

- Up to 18 onshore cables (three HVAC cables per circuit) will be laid in six trenches within the 200 m indicative permanent cable area. Cables will be installed by direct lay or pulled through installed ducting (e.g. at HDD crossings). Buried transition joint bays will be provided at intervals. The temporary works area for the onshore cables will be 80 m wide, increasing at HDD locations and will include a haul road and topsoil and subsoil storage areas. The permanent cable corridor will be 60 m wide. Temporary construction compounds will be provided at strategic locations along the ECC, together with temporary access from the local road network within the 700 m indicative temporary works area.

- Where practicable, less intrusive construction methods will be adopted in favour of open-cut trenching, for example, by using HDD to cross environmentally sensitive water courses, major roadways and railways.

- The onshore substation and energy balancing facility will occupy a permanent area of 16 ha, with an additional 10 ha area required temporarily for construction within the onshore substation search area. The onshore substation will include up to five main buildings of maximum height 30 m.

- During operation it is anticipated that maintenance and repair activity outside of the substation site will be minimal.

- Decommissioning will involve the complete removal of the substation and energy balancing facility and restoration of the site. The onshore cables will be left in situ.

- Sensitive receptors could be exposed to construction dust that is generated within the temporary and permanent project footprint defined by the substation search area, the landfall search area and the 700 m indicative temporary works area of the ECC. The locations and extents of activities will be refined as route planning and site selection and design progress.

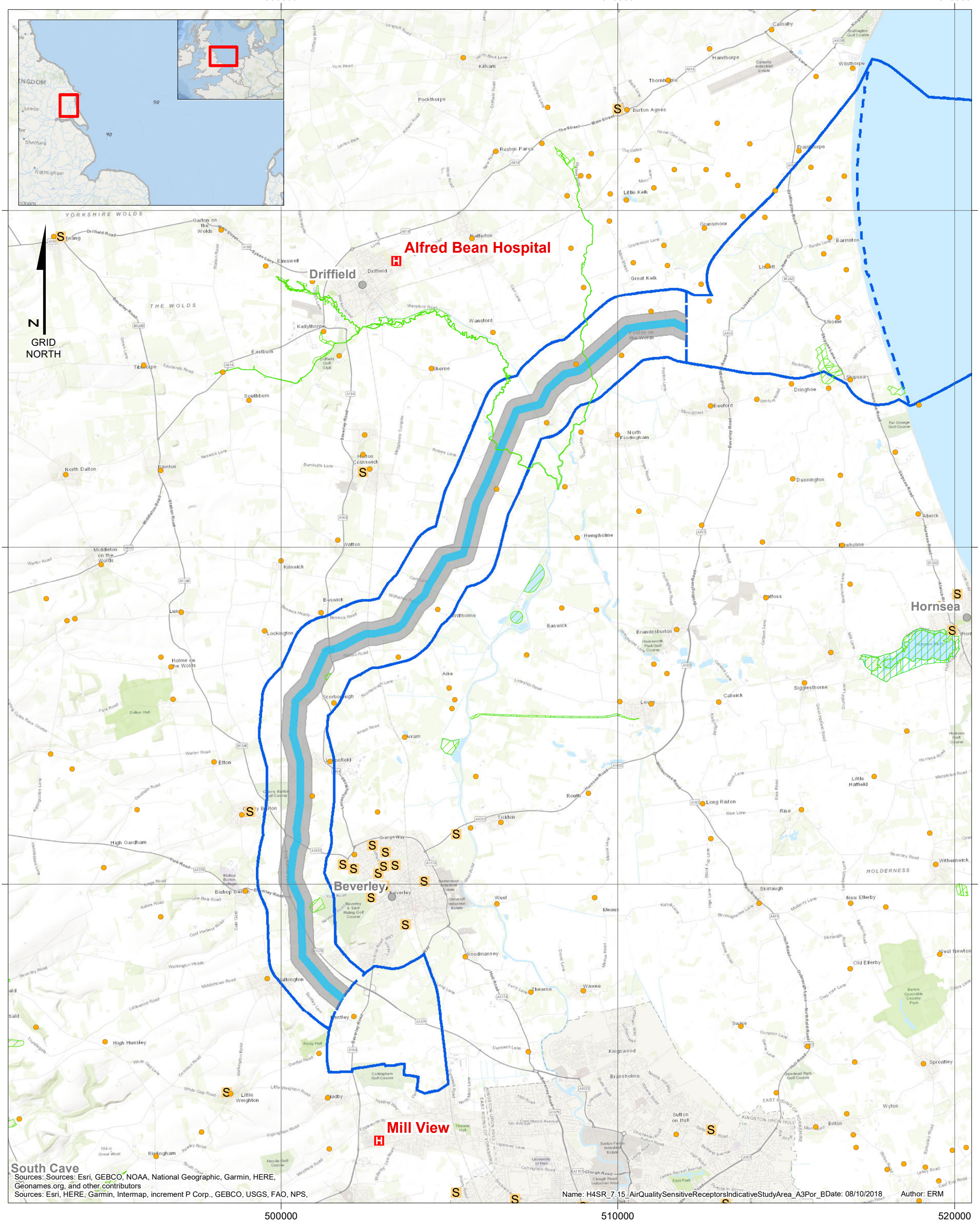
- Construction traffic generated on the local road network will emit pollutants to air.

- Operational traffic will be negligible and operational maintenance will lead to no appreciable dust emissions. Hornsea Four will have negligible impacts on air quality during operation.

7.9.4.3 Along the scoping boundary and buffer the sensitivity of receptors within the radius of potential impact from dust raising (350 m), are medium which is relevant for the general population and sensitive ecology. High sensitivity applies to hospitals and schools, none of which have been identified in the study area. **Figure 7-15** shows potential receptors that may be sensitive to changes in air quality within the study area.

7.9.4.4 Following the methodology set out by the IAQM, traffic impacts can be screened out if the maximum increase of Heavy Goods Vehicles will be less than 100 as the Annual Average Daily Traffic (AADT) and the maximum number of Light Duty Vehicles will be less than 500 AADT. Neither of these thresholds is anticipated to be exceeded.

7.9.4.5 The basis for assessment also includes the embedded mitigation where appropriate.



Scoping Boundary

Scoping Boundary Component

Indicative Permanent Cable Area

Indicative Temporary Works

Settlements

Town

Village

Sensitive Receptors (Open Street Mapping)

S Schools, Nursery, Colleges

H Hospitals

Site of Special Scientific Interest Areas (Natural England)

Special Protection Area (Natural England)

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres

0 1 2 3 4 Miles

Hornsea Four

Air Quality Sensitive Receptors and Indicative Study Area

Figure: 7.15

Document no: H4SR_7.15
Created by: AA
Checked by: YV
Approved by: NL

ERM

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7.9.5 Embedded Mitigation

7.9.5.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts due to emissions of dust from construction activities (see Table 7-26). These will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation. They will be fed iteratively into the assessment process and updated in the impacts register which is presented in full in Annex A.

7.9.5.2 As there is a commitment to implementing these measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of Hornsea Four and have, therefore, been considered in the assessment presented in Section 7.9.6 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 7-26 Relevant Air Quality Commitments

ID	Measure Proposed	How the measure will be secured
Co41	Primary: All trenchless crossings will be undertaken by non-impact methods and, as such, construction vibration would be unlikely to be significant beyond the immediate location of works. No blasting is anticipated.	CoCP and DCO requirement
Co64	Tertiary: During construction of the cable trenches the topsoil and subsoil will be stripped and stored on site within the temporary working corridor of the Hornsea Four onshore cable corridor. The topsoil and subsoil will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). No material will be stockpiled within the flood zone of any watercourse.	CoCP and DCO requirement
Co114	Tertiary: Best practice air quality management measures will be applied as described in Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction 2014, version 1.1, where relevant and practicable to the activities being undertaken.	CoCP and DCO requirement
Co124	Tertiary: Adoption of an agreed Construction Code of Practice to minimise temporary disturbance to residential properties, recreational users, and existing land users.	CoCP and DCO requirement

7.9.6 Likely Significant Effects

7.9.6.1 Table 7-27 sets out an assessment of air quality effects at the scoping stage of the EIA process. The table is drawn from the Impacts Register (presented in Annex A) which is a tool to aid a proportionate approach to the EIA. The Impacts Register is a live document

that will continue to be developed alongside the design process as Hornsea Four proceeds, and in response to consultee inputs in the form of the Scoping Opinion, section 42 and 47 consultation, the Evidence Plan process and at PEIR.

7.9.6.2 The assessment presented in **Table 7-27** is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; embedded mitigation (as set out in **Table 7-26**, together with the means by which it will be secured); the level of understanding of the baseline at this stage; the evidence base for air quality effects; relevant policy; the assessment criteria provided in **Annex C**; the question-led approach set out in **Section 1.7**; and the professional judgement of qualified air quality experts.

7.9.6.3 **Table 7-27** is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in as simple or detailed. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

7.9.6.4 The extent to which an impact could contribute cumulatively with other impacts to result in significant effects on an aspect of the receiving environment is considered in **Chapter 8** Cumulative Effects.

Table 7-27 Likely Effects – Air Quality

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Dust generation: Construction phase Dust raising activities (earthworks, traffic on unpaved areas, construction works) from onshore construction works. This may have an effect on human and ecological receptors sensitive to dust and PM_{10}.	Primary Co41 Tertiary: Co64 Co114 Co124	Negligible	Medium	**No likely significant effects**	**Scoped out**	None
Dust generation and exhaust emissions from traffic: All phases Construction, operational (maintenance of onshore export cable) and decommissioning related traffic will be associated with emissions of dust and exhaust gases, which may affect human and ecological receptors.	None required.	Negligible	Medium	**No likely significant effects**	**Scoped Out**	None
Emissions from facilities: Operational phase Operation and maintenance of the onshore export cable and onshore substation may affect human and ecological receptors.	None required.	No change	Negligible	**No likely significant effects**	**Scoped out**	None
Dust generation: Decommissioning phase Temporary impacts of decommissioning of the OnSS may affect receptors sensitive to dust (human and ecological).	Primary: Co41 Tertiary: Co64	Negligible	Low	**No likely significant effects**	**Scoped out**	None

	Col14 Col24					

7.9.7 Impacts Scoped Out of Assessment

7.9.7.1 The impact on air quality of project activities as identified in **Table 7-27** is considered to be not significant, because of a number of considerations:

- During Construction:
  a. embedded mitigation as set out by the IAQM (IAQM, 2014), is designed to reduce impacts to negligible magnitude;
  b. along the 700 m indicative temporary works area and buffer, there is a risk of dust impacts on receptors within the radius of potential impact from dust raising (350 m), that will require mitigation;
  c. within IAQM there are levels of mitigation linked to the level of risk of impact, and additional mitigation will be utilised where there are receptors within 350 m of construction working areas;
  d. all sensitive receptors will be mapped in relation to the final project footprint and mitigation measures will be clearly described for works and locations that could put these receptors at risk ; and
  e. the maximum increase of HDV movements over any one route will be less than 100 AADT and the maximum number of LDV movements will be less than 500 AADT. Traffic can therefore be screened out as per IAQM Guidance (IAQM, 2017).
- Operation and Maintenance: Maintenance activities are expected to be small scale and short time-frame, as well as associated with best practice mitigation measures;
- Decommissioning:
  a. Embedded mitigation measures are robust and should suffice to keep impact magnitude to negligible or at most small;
  b. The onshore substations search area is situated in a rural area, with <10 receptors (human and ecological) in a radius of 350 m around construction activities, none of which of are more than medium sensitivity.

7.9.8 Proposed Approach to the PEIR and ES

7.9.8.1 The potential impacts are such that all aspects relating to air quality have been scoped out. However, in terms of dust and PM_{10} emissions from construction activities, this is on the basis that emissions can be mitigated to the point that residual impacts are negligible. Therefore, air quality will be considered in the PEIR within the detailed construction planning and detailed mitigation set out in the CoCP for Hornsea Four.

7.9.9 Scoping Questions for Consultees

7.9.9.1 Scoping questions for ERYC in relation to air quality include:

- Have all potential impacts on air quality been identified?
- Do you agree with a risk-based approach to the development of mitigation of dust impacts following IAQM 2014 such that vulnerable receptors are identified, mitigation is incorporated into a CoCP and with tertiary mitigation in place no significant effects on these receptors will occur?

- Do you agree with the conclusion to scope air quality impacts out from further assessment and to concentrate on the mitigation methods that will be applied to avoid significant effects?

7.10 Socio-Economic Characteristics

7.10.1 Introduction

7.10.1.1 This section of the Scoping Report identifies the socio-economic characteristics of relevance to Hornsea Four and considers the potential effects from procurement, construction and operation (including maintenance); decommissioning activities will involve the procurement of employment, goods and services but are too distant in the future to make any meaningful assessment in this EIA of the benefits to the regional and national economies at that time. Due to the nature of Hornsea Four the potential for likely significant effects is largely limited to the procurement and construction phases but will continue through operation and maintencance (and on to decommissioning).

7.10.2 Study Area

7.10.2.1 Given the location of Hornsea Four, the proposed Study Area for the assessment of effects on employment and economy is the East Riding of Yorkshire and Humber region, with some focus on the East Riding of Yorkshire and Kingston upon Hull. At this stage it is not possible to identify specific locations that will support the offshore construction of Hornsea Four. Support locations for offshore construction and operations will depend on commercial decisions to be made at a later date, which in turn will be influenced by several economic, technological and other factors. Since the Yorkshire and Humber region, by virtue of a number of characteristics, represents a realistic economy for supporting both onshore and offshore construction and operation, it is taken as the Study Area for the purposes of EIA scoping. However, this does not mean categorically that economic benefits will partially or wholly accrue to this region and the Study Area may be amended or expanded as Hornsea Four design and the EIA progress.

7.10.2.2 For tourism and recreation the Study Area is a reduced one and focused on the local administrative areas that contain the scoping boundary (as described in section 7.6).

7.10.3 Baseline Environment

7.10.3.1 A high level desk study has been undertaken to provide an overview of the main demographic, economy and employment characteristics of the Study Area.

7.10.3.2 The main sources of information include the following:

Source	Summary	Coverage of Hornsea Four development area
East Riding Economic Strategy, 2018 - 2022	This document identifies the priorities for economic development	Full coverage of the East Riding of Yorkshire and Kingston upon Hull.

Source	Summary	Coverage of Hornsea Four development area
	in the East Riding and will act as a blueprint in guiding economic activity for the next four years, with the key aim of promoting growth.	
Centreforcities, 2015	Review of 'The Geography of the Humber Economy' to provide an overview of the main demographic, economy and employment characteristics of the Study Area.	Full coverage of the East Riding of Yorkshire and the Humber, with some focus on the East Riding of Yorkshire and Kingston upon Hull.
Humber Local Enterprise Partnership	Review of the Humber Strategic Economic Plan July 2016 and Strategic Economic Plan 2014-2020 provide an overview of the main demographic, economy and employment characteristics of the Study Area.	Full coverage of the East Riding of Yorkshire and the Humber, with some focus on the East Riding of Yorkshire and Kingston upon Hull.
Logistics Institute, Hull University Business School, June 2016	Review of 'The State of the Humber Economy' provides an overview of the main demographic, economy and employment characteristics of the Study Area.	Full coverage of the East Riding of Yorkshire and the Humber, with some focus on the East Riding of Yorkshire and Kingston upon Hull.

7.10.3.3 The total population of the Humber has increased by 0.4% (3,900 people) over the period 2012 to 2015, a much slower rate than the national average of 2.4%. The largest increases were reported in North Lincolnshire and Hull with rises of 0.9% and 0.7% respectively. Overall, the working age population has fallen by 1.6% to 572,300 people in 2015, which is in contrast to the increase of 1.1% recorded nationally.

7.10.3.4 With regard to a number of economic, employment, skills, social mobility, entrepreneurship and innovation metrics the Humber region is behind many parts of the UK. However, there are a number of areas of opportunity, for example gross value added (GVA) per job in manufacturing is high. In 2014, the Humber economy generated £17.5bn in GVA, an increase of 3.7% (or £630m) over 2012. The region is positioned to quickly diversify its economy allowing it to focus on the sectors with potential for growth. This process should be facilitated by the region's many core strengths, which include: the Humber ports on both banks; its long-established maritme history; the strong links to European ports and markets; the growing renewable energy sector; the investment by industry in offshore wind and the potential to develop the associated supply chain; key leading industries already present in the region; and the University of Hull and local colleges.

7.10.3.5 The Humber region has reported positive performances aross all major economic indicators since 2012 and has returned to economic growth. The employment rate has risen by 3.9% to 72.4% across the Humber Region over the period from June 2013 to March 2016. Total jobs in the Humber region increased by 20,000 between 2012-2014, which represents an

increase of 5.0% and is slightly above the employment growth rates reported regionally and nationally. Half of these additional jobs have been created in the East Riding of Yorkshire. The East Riding of Yorkshire has seen a net increase of 14,000 jobs between 2012-2016 and has an employment rate of 77.2%. The Humber Region's occupational profile is skewed towards lower skilled occupations though the situation has improved between June 2013 and March 2016. Lower skilled occupations now account for 30.1% of all occupations across the Humber Region compared with a national average of 24.6%. The long-term challenge is to create a greater number of highly-skilled jobs across the region.

7.10.3.6 The 2015 Indices of Multiple Deprivation reported that the number of Lower Super Output Areas across the Humber ranked in the 10% most deprived decile had fallen from 24.0% to 22.0% since the last report was published in 2010. Significant improvements were recognised across a range of sub-domains including health and crime. In the East Riding of Yorkshire, 10% are living in fuel poverty (2015) which is below the regional and national averages of 12.4% and 11% respectively.

7.10.3.7 The 2014-2020 Strategic Economic Plan for the Humber states that by 2020 the area is expected to have a thriving renewables sector, with ambitious capital schemes underway and a growing reputation for excellence and expertise. Many thousands of jobs are expected to be created, driven by this major growth in renewables alongside the further strengthening of other key sectors mentioned previously. It is also anticipated there will be a skills system that is better aligned with the current and future needs of their economy. The proportion of the working age population with no qualifications is expected to decrease significantly and and another period of above average growth in higher level skills is expected.

7.10.4 Project Basis for Scoping Assessment

7.10.4.1 Hornsea Four is a significant infrastructure project that will involve substantial capital investment for such matters as:

- the fabrication, transport and installation of up to 180 wind turbine generators (including gearboxes, transformers, power electronics and control equipment and up to 540 rotors);
- up to 180 steel or concrete turbine bases;
- one or more offshore sub-stations;
- several hundred kilometres of electrical cable connecting the turbines to offshore substations and thence to shore;
- multiple specialist installation and support vessels; and
- an onshore sub-station.

7.10.4.2 Throughout its operational lifetime, operations will be controlled and monitored and on-going maintenance support will be provided.

7.10.4.3 At the EIA stage is is not possible to state whether Hornsea Four will contribute to any specfic local economy (e.g. the Humber region) or economies. This is because the way in which the investment and expenditure will be distributed between regions and potentially with other European countries will largely depend upon the supply chain strategies that are adopted by the consented project.

7.10.4.4 In addition the likely capacity of Hornsea Four is yet to be determined at this stage and hence the scale of the investment (and the extent of opportunities for employment and to provide services) could vary across a range of values.

7.10.4.5 The project basis of assessment at scoping, therefore, is that Hornsea Four will represent a material but presently indeterminate opportunity for economic benefits in terms of employment and the provision of services, together with knock-on benefits in the Study Area economy and nationally.

7.10.5 Embedded Mitigation

7.10.5.1 As part of the Hornsea Four design process a number of designed-in measures have been proposed. Relevant measures described in other sections of this Scoping Report (e.g. for commercial fisheries, traffic and transport, land use) will serve to to reduce the potential for adverse impacts on socio-economic aspects and are not repeated here.

7.10.5.2 At this stage it is not practicable to embed mitigation to provide econominc benefits (i.e. enhancement); however, Hornsea Four will endeavour to enhance the benefits available to the local and national economies to the extent practicable through the following general measures.

- Hornsea Four will identify opportunities for companies based or operating in the Yorkshire and Humber region to access the project's supply chain.

- Hornsea Four will work with local partners and seek to maximise the ability of local people to access employment opportunities associated with the construction and operation of the project.

7.10.5.3 It is not considered appropriate or practicable to secure commitments to provide benefits through condition or DCO requirements given the uncertainty over how goods, services and employment will be procured. However, developing people with the right skills to deliver the UK's offshore wind ambitions is a key priority for Ørsted. In the UK, Ørsted's activities include delivering a programme of skills initiatives at local and regional levels across the UK. To date, this has included a partnership with Teach First, supporting/collaborating with University Technical Colleges, establishing an apprenticeship scheme on both the east and west coast and, ring-fencing funds for skills. Science, Technology, Engineering, and Math initiatives through Ørsted's voluntary Community Benefit Funds.

7.10.5.4 Once the scale of economic opportunity likely to arise locally is apparent, Hornsea Four will work with the Humber Local Enterprise Partnership (LEP) and wider stakeholders to identify skills and supply chain needs in the local area and maximise local economic benefit.

7.10.5.5 Should consent for Hornsea Four be granted, Hornsea Four would assess, in partnership with the LEP, the need for additional actions to support local economic benefits. Effective communication between Hornsea Four and relevant stakeholders as local opportunities become clear will help local businesses and authorities to plan for the supply chain and skills demand associated with Hornsea Four.

7.10.5.6 Additionally, based on the nature and scale of local economic opportunities, Hornsea Four will explore whether there is a case for targeted actions to develop labour market capability. Hornsea Four will develop and deliver a Skills and Employment Plan.

7.10.5.7 Hornsea Four's approach to delivering benefits will evolve over the project development process as the EIA progresses and in response to S42 and S47 consultation and this will be reported in the PEIR and ES accordingly.

7.10.6 Likely Significant Effects

7.10.6.1 **Table 7-28** sets out an assessment of likely significant socio-economic effects at the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of Hornsea Four at this scoping stage of the EIA; the level of understanding of the baseline at this stage; the evidence base for socio-economic effects; relevant policy and professional judgement. The assessment presented in the table seeks to: scope certain matters out of further assessment; indicate those matters that are effectively addressed within other EIA topics; and indicate the type of assessment to be undertaken for matters scoped in. In accordance with PINS advice note 7 the assessment has taken a question-led approach to the extent practicable.

1. Is there an impact pathway from Hornsea Four to the socio-economic aspect/issue? For example: to what extent is the Study Area's economy positioned to derive potential benefits from the project?
2. Is the aspect/issue sensitive to the impact concerned? For example is the local cost of living likely to be influenced by the influx of a temporary construction workforce and demand for goods and services?
3. Is the impact likely to be of a scale that may result in significant effects on the aspect/issue? For example could temporary construction workforce in-migration skew the demographic characteristics of the Study Area, exert demands on social, health and accommodation beyond the capacity of the region to provide?
4. Are there mechanisms in place which facilitate a project like Hornsea Four providing/enhancing benefits? For example have similar mechanisms been put in place and been successful for other projects and procurement activity, e.g. increasing UK supply chain content via significant investments in UK offshore wind

manufacturing facilities such as MHI Vestas' blade manufacturing plant on the Isle of Wight and the Siemens offshore wind blade plant in Hull?

5. Is there sufficient confidence in measures for providing benefits in terms of deliverability and efficacy?

7.10.6.2 Adopting this question-led approach it is apparent that many socio-economic aspects and issues are either not especially relevant to Hornsea Four or will be addressed elsewhere in the EIA. Table 7-28 sets these out along with brief explanations.

Table 7-28 Socio-economic Aspects and Issues Relevant for Hornsea Four

Valued Socio-economic Aspects	Typical Issues	Comment Onshore	Comment Offshore
Health and well-being	Could Hornsea Four affect individual and community / population health group cohesion?	No likely significant effects. While there will be a large construction workforce, much of it will be drawn from local and regional resources and no single community will be exposed to large-scale temporary in-migration of workers.	Not applicable
	Could Hornsea Four affect community safety?	Will be addressed in the Traffic and Transport assessment. Other community safety factors (such as fencing and security of working areas) will be addressed in a CoCP.	Will be addressed in 'Shipping and Navigation' to the extent applicable
	Could Hornsea Four affect family cohesion?	No likely significant effects, not relevant to Hornsea Four.	
	Could Hornsea Four affect cultural maintenance?	No likely significant effects, not relevant to Hornsea Four.	
Sustainable natural resource harvesting, land access and use	Could Hornsea Four affect hunting and gathering activities (noting this mainly applies in traditional economies onshore, but offshore does apply to commercial fisheries)?	No likely significant effects, not relevant to Hornsea Four.	Will be addressed under 'Commercial Fisheries'.
	Could Hornsea Four affect the recreational and traditional economy, e.g. through interrupting access to land and sea?	Will be addressed under 'Land Use and Agriculture' together with landowner and	Will be addressed under 'Commercial Fisheries' and 'Other Marine Users'.

Valued Socio-economic Aspects	Typical Issues	Comment Onshore	Comment Offshore
		land-user consultations.	
	Could Hornsea Four affect the value of alternative land uses (e.g. tourism vs. fishing vs. industry)?	Not applicable to Hornsea 4 as any displaced land or sea uses will be compensated.	
Protected heritage and cultural resources	Could Hornsea Four affect the aesthetic, cultural, archaeological and/or spiritual value of places?	Will be addressed under 'Cultural Heritage'.	Will be addressed under 'Marine Archaeology'.
	Could Hornsea Four affect the maintenance of traditional language, education, laws and traditions?	No likely significant effects, not relevant to Hornsea Four.	
Equitable business and employment opportunities	Could Hornsea Four affect local, regional and national business competitiveness?	Relevant given Humber region context and supply chain. See **Section 7.10.7** below.	
	Could Hornsea Four provide employment opportunities for local, regional and national residents?	Relevant given Humber context and supply chain. See **Section 7.10.7** below.	
	Could Hornsea Four facilitate training and career development for local and regional residents?	Relevant given Humber region context. See **Section 7.10.7** below.	
	Avoidance of boom and bust cycles (e.g. via economic diversification)?	No likely significant effects, not relevant to Hornsea Four.	
Population sustainability	Could Hornsea Four cause or exacerbate in- and out-migration effects?	No likely significant effects. While there will be a large construction workforce, much of it will be drawn from local and regional resources and no single community will be exposed to large-scale temporary in-migration of workers.	
	Could Hornsea Four cause changes in social and cultural makeup of affected communities	No likely significant effects, not relevant to Hornsea Four.	
Adequate services and infrastructure	Could Hornsea Four lead to pressures on social services such as health care, education and justice?	No likely significant effects. While there will be a large construction workforce, much of it will be drawn from local and regional resources and no single community social service will be exposed to large-scale demand from workers.	
	Could Hornsea Four cause or exacerbate housing pressures, e.g. affordability, availability and appropriateness?	No likely significant effects. While there will be a large construction workforce, much of it will be drawn from local and regional resources and demand for temporary accommodation by those hired from outside the region will be distributed over a relatively wide area and unlikely to compete with others (e.g. domestic or tourism) for availability.	

Valued Socio-economic Aspects	Typical Issues	Comment Onshore	Comment Offshore
	Could Hornsea Four have implications for traffic and road safety and maritime transport, e.g. through pressures on physical infrastructure?	Will be addressed under 'Traffic and Transport'.	Will be addressed under 'Shipping and Navigation'.
	Could Hornsea Four lead to pressures on other infrastructure?	No likely significant effects. Other infrastructure will be considered by Hornsea Four in terms of avoidance in the first instance and appropriate design measures (e.g. for road crossings) where avoidance is not possible.	Will be addressed under 'Aviation, Radar, Military and Communications' and 'Marine Infrastructure (Other Marine Users)'.
Adequate sustainable income and lifestyle	Could Hornsea Four affect the overall amount of money in the community?	Some potential relevance given Humber context and supply chain. See Section 7.10.7 below.	
	Could Hornsea Four affect influence uses of money in the community, e.g. through effects of increased disposable income?	Some potential relevance given Humber context and supply chain. See Section 7.10.7 below.	
	Could Hornsea Four affect the local and regional cost of living?	No likely significant effects, not relevant to Hornsea Four.	
	Could Hornsea Four affect the distribution of costs/benefits among affected people-impact equity?	To be addressed as part of assessing employment opportunities for local, regional and national residents. See Section 7.10.7 below.	
	Could Hornsea Four lead to adverse lifestyle changes, e.g. increased gambling, crime, substance abuse?	No likely significant effects, not relevant to Hornsea Four.	

7.10.7 Proposed Approach to the PEIR and ES

7.10.7.1 The socio-economic effects of the complete Hornsea Four project (i.e. offshore and onshore) will be assessed together and presented in a single chapter of the PEIR (and ES).

7.10.7.2 The socio-economic impact assessment will focus on the economy and employment aspects of Hornsea Four construct and operation. The assessment will generally present the effects in terms of the employment impacts within the Study Area expressed as Full Time Equivalent (FTE) jobs and the Gross Value Added (GVA) as a result of these jobs.

7.10.7.3 The assessment will address the following.

- Direct economic effects: these are jobs and GVA that are derived predominantly or wholly or from the construction, operation and maintenance of Hornsea Four generated in the Study Area.

- Indirect economic effects: these are jobs and GVA generated in the economy of the Study Area via the chain of suppliers of goods and services to the direct Hornsea Four activities.

- Induced economic impacts: these are jobs and GVA created by direct and indirect expenditure by employees' in the Study Area.

- Wider economic effects: these relate to employment and income generated in the economy related to the wider role of Hornsea Four in influencing economic activities such as investment by other players in the offshore wind and related sectors. This will include the effects on inward investment elsewhere within, for example, the construction sector and specialist provision of services (e.g. marine construction) and equipment (e.g. turbine rotors) and on other sectors of the economy.

7.10.7.4 In the absence of a decision on capacity the above benefits will be represented in terms of ranges but with the lowest likely capacity representing a 'worst case'assessment of economic benefits (i.e. the lower end of the investment range).

7.10.7.5 To the extent it is relevant, the negative economic effects on the economy and employment will be assessed where, for example, negative impacts on tourism and other sectors are identified in other EIA technical topic assessments.

7.10.7.6 In regard to cumulative effects, Hornsea Four will be set against a background of a variety of economic development activity and in a regional. The socio-economic assessment described above will consider the contribution of Hornsea Four to the local, regional and national economy to the extent practicable. However, it is not proposed that positive cumulative effects with other plans and proposals are specifically assessed. This is because such benefits are a desired outcome of local, regional and national policies for economic development and Hornsea Four will simply be adding to the benefits provided from other planned development.

7.10.8 Scoping Questions for Consultees

1. Do you agree that the following socio-economic aspects and issues will be adequately addressed by other EIA topics: community safety (Traffic and Transport, Shipping and Navigation); natural resource harvesting (Commercial Fisheries); recreational and traditional economy (Land Use and Agriculture, Commercial Fisheries, Other Marine Users); protected heritage and cultural resources (Cultural Heritage, Marine Archaeology); traffic and road safety and

maritime transport (Traffic and Transport, Shipping and Navigation); and pressures on other infrastructure (Project Description design commitments, Aviation, Radar, Military and Communications and Marine Infrastructure (Other Marine Users))?

2. Do you agree that where there is the potential for a significant effect on employment and the economy that alone will be assessed and reported in the socio-economic impact assessment?
3. Do you agree that a number of typical socio-economic aspects and issues are not relevant to Hornsea Four and can be scoped out from further assessment, including: individual and community / population health group cohesion; family cohesion; cultural maintenance; traditional hunting and gathering activities onshore; value of alternative land uses; maintenance of traditional language, education, laws and traditions; triggering boom and bust cycles; causing or exacerbating in- and out-migration effects; changes in social and cultural makeup of affected communities; pressures on social services such as health care, education and justice; causing or exacerbating housing pressures; affecting the local and regional cost of living; and leading to adverse lifestyle changes?
4. Do you agree that the primary focus of the socio-economic impact assessment should be on the effects on employment and the economy at suitable scales (eg regional and national)?
5. Are there recognised mechanisms for projects like Hornsea Four to provide/enhance benefits that the East Riding of Yorkshire Council could identify? For example have similar mechanisms been put in place and been successful for other projects in the region?
6. Do you agree that in the absence of a decision on capacity the above benefits can be represented in terms of ranges but with the lowest likely capacity representing a 'worst case'assessment of benefits (i.e. the lower end of the investment range)?
7. Do you agree that decommissioning is an activity too distant in the future to conduct a meaningful assessment of the economic benefits?Do you agree that the cumulative positive benefits of Hornsea Four with other plans and proposals are a desired outcome of local, regional and national policy and do not need to be specifically quantified in an assessment.

8 Cumulative Effects

8.1 Introduction

8.1.1.1 The following sections of this chapter describe the proposed approach to the Cumulative Effects Assessment (CEA) for Hornsea Four. Cumulative effects result from the combined impacts of Hornsea Four with other projects / plans on the same single receptor or resource. Their consideration is important as the effects of a development in isolation may not be significant but when combined with the effects of other projects they may be. In-combination effects are defined as the combined effect of Hornsea Four, in combination with the effects from a number of different projects, on European Conservation Site integrity. In-combination effects will be presented within the HRA.

8.1.1.2 NPS EN-1[11] makes reference to consideration of cumulative effects in paragraph 4.2.5, stating that:

> *"The ES should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence)."*

8.1.1.3 PINS advice note 17 (Cumulative effects assessment relevant to nationally significant infrastructure projects) goes on to emphasise the importance of considering cumulative effects in the context of the EU EIA Directive, the 2017 EIA Regulations Regulatory and the above mentioned NPS EN-1. Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms [12] sets out guidelines to follow in the context of the offshore wind farm consenting process.

8.1.1.4 In most instances development already in existence will be captured in the baseline for Hornsea Four and the normal practice of 'adding' impacts from Hornsea Four to the baseline will assess the cumulative effect.

8.1.1.5 However, to fully assess its effects, Hornsea Four will not be considered in isolation. A fundamental requirement of undertaking the CEA is to identify those foreseeable developments or activities with which Hornsea Four may interact to produce a cumulative impact. Interactions have the potential to arise during the construction, operation and maintenance, and decommissioning phases. The CEA will include other projects / plans that may begin construction or operation or be decommissioned within the same period as Hornsea Four construction or operation. Decommissioning of Hornsea Four itself is too far into the future to allow any meaningful consideration of cumulative effects with other planned projects, and is therefore not addressed. Decommissioning will be undertaken in accordance with a decommissioning plan and can be planned at the time, to avoid potential cumulative effects with presently unforeseeable other plans and projects.

[11] Overarching National Policy Statement for Energy (EN-1), July 2011
[12] Renewable UK (2013) Cumulative Impact Assessment Guidelines Guiding Principles For Cumulative Impacts Assessment In Offshore Wind Farms

8.1.1.6 Hornsea Four will therefore be considered in the context of both baseline conditions and together with other developments which are in planning or may be developed in the future, and the resultant environmental effects of the other developments coexisting. The assessment will consider the accumulation of effects on people and the environment, even if Hornsea Four, when assessed on an individual basis, has effects that are not significant.

8.1.1.7 The Hornsea Four Cumulative effects assessment will follow the approach set out in Advice Note 17 and, for the offshore elements especially, be consistent with the guidance provided by the RenewableUK and the Natural Environment Research Council (NERC) published guidelines on the undertaking of the CEA.

8.2 Approach Overview

8.2.1.1 For another development to be considered in the cumulative assessment, the principles set out in the guidance documents discussed above will be followed, meaning that only other developments that could reasonably be presumed to go ahead or are going ahead (including Hornsea Projects One, Two and Three) and for which sufficient information is available will be taken into account.

8.2.1.2 For the purposes of the CEA, the types of other developments to be are made up of:

- those that are under construction;
- those that have planning permission or marine licences;
- those for which planning or marine licence applications have been submitted to the relevant authority;
- those which are on the Planning Inspectorate's Programme of Projects whether a scoping report has been submitted or not;
- those that are identified in development plans and in other plans and programmes as may be relevant; and
- with regard to all the above are of a scale, nature, geographic location and temporal overlap to contribute to potential cumulative effects along with Hornsea Four.

8.2.1.3 The CEA will focus on developments in proximity to Hornsea Four which may have impacts on the same resources and receptors as Hornsea Four. Generally, only other developments where an EIA was required are considered appropriate for inclusion. Each of these other developments has been screened as part of the EIA scoping exercise to establish the likelihood of adverse cumulative effects with Hornsea Four. Where potential cumulative environmental effects have been identified, these will be considered further in the relevant topic assessments in the EIA and reported on in the PEIR.

8.2.1.4 The CEA process is generally divided into a screening stage and an assessment stage. The approaches to each are described for offshore and onshore in the following sections. It should be noted that there are slight differences in approaches. The offshore CEA follows the accepted guidance of RenewableUK which is specific to the marine elements of an offshore wind farm. A key influence on offshore CEA is the need to consider wide ranging species (foraging species, migratory routes etc) and this influences matters such as the

spatial and temporal scope of an offshore CEA. For a project of this nature, the onshore CEA requires a less complex approach, and therefore the screening stage has been completed.

8.3 Offshore Cumulative Effects Assessment

8.3.1 Screening stage

8.3.1.1 In order to provide a comprehensive CEA of all relevant projects that could interact with an offshore renewable project, the Southern North Sea Offshore Wind Forum has produced an extensive list of plans, projects and activities occurring within a large study area encompassing the greater North Sea area and beyond. This list of projects is commonly referred to as the CEA long list. The CEA long list will act as one of the key information sources to identify projects that could potentially have a cumulative impact with the offshore elements of Hornsea Four.

8.3.1.2 A specialised process will be developed and implemented within the CEA to methodically and transparently screen the large number of offshore projects and plans that may be considered cumulatively alongside Hornsea Four. This will involve a stepwise process that considers the level of detail available for other projects/plans, as well as the potential for interactions to occur on the following basis.

- Conceptual overlap: for a conceptual overlap to occur it must be established that such an impact has the potential to directly or indirectly affect the receptor(s) in question. In EIA terms this is described as an 'impact-receptor pathway' and is defined here as a conceptual overlap.

- Physical overlap: a physical overlap refers to the ability for impacts arising from Hornsea Four to overlap with those from other projects/plans on a receptor basis. This means that, in most examples, an overlap of the physical extents of the impacts arising from the two (or more) projects/plans must be established for a cumulative impact to arise. Exceptions to this exist for certain mobile receptors that may move between, and be subject to, two or more separate physical extents of impact from two or more projects.

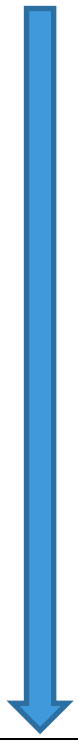
- Temporal overlap: in order for a cumulative impact to arise from two or more projects, a temporal overlap of impacts arising from each must be established. It should be noted that some impacts occur only during certain phases of development, such as piling noise during construction. In these cases, it is important to establish the extent to which an overlap may occur between the specific phase of Hornsea Four and the corresponding phase of other projects/plans.

8.3.1.3 The absence of a strict overlap, however, may not necessarily preclude a cumulative impact, as receptors may become further affected by additional, non-temporally overlapping (i.e. sequential) projects.

8.3.2 Assessment stage

8.3.2.1 Once a project has been taken forward to the assessment stage, a tiered approach is proposed for the CEA. The tiered approach provides a framework to assist the decision maker in placing relative weight upon the potential for each project/plan assessed cumulatively to ultimately be realised, based upon the project/plan's current stage of maturity. The allocation of projects/plans into tiers is not affected by the screening process, but is merely a categorisation applied to all projects/plans that have been screened in for assessment.

8.3.2.2 The tiered approach will consider Hornsea Four alongside other projects/plans in the following categories.

Tier 1	• other project/plans currently under construction and those that are currently operational that were not operational when baseline data was collected, and/or those that are operational but have an on-going impact;	Decreasing level of detail likely to be available 
	• consented application(s), whether under the Planning Act 2008 or other regimes, but not yet implemented;	
	• submitted application(s) whether under the Planning Act 2008 or other regimes but not yet determined	
Tier 2	• those projects likely to come forward but that have not yet submitted an application for consent (the PINS programme of projects is the most relevant source of information), including all projects where a Scoping Report has been submitted.	
Tier 3	• projects on the Planning Inspectorate's Programme of Projects where a scoping report has not been submitted	
	• development proposals identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited	
	• development proposals identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.	

8.3.2.3 The tiered approach (as set out above) is consistent with PINS Advice Note Seventeen: (PINS, 2015a) and the Renewable UK CIA Guidelines, specifically Guiding Principle 4 and Guiding Principle 7 (Renewable UK, 2013).

8.3.2.4 Those projects/plans that have been screened into the CEA via the screening process will be allocated into one of the above Tiers and assessed for cumulative impact.

8.4 Onshore Cumulative Effects Assessment

8.4.1 Introduction

8.4.1.1 The CEA includes six distinct stages as follows.

- Stage 1: identifying impacts from Hornsea Four that may contribute to cumulative effects on resources and receptors and defining the zone of influence (ZoI) of the Hornsea Four impacts in terms of specific geographical and temporal boundaries (corresponds with Stage 1 of PINS advice note 17).

- Stage 2: identification of third party developments whose potential impacts may interact with the Hornsea Four impacts ZoIs (corresponds with Stage 1 of PINS advice note 17).

- Stage 3: screening the Hornsea Four impacts identified in Stage 1 above to establish their potential for acting cumulatively on resources and receptors with potential impacts from the long-list of third party developments, and from this produce a shortlist of third party developments to be taken forward in the CEA (corresponds with Stage 2 of PINS advice note 17).

8.4.1.2 The above three stages identify the other developments and specific topics scoped into the EIA for further assessment. The following three stages set out how the cumulative effects will be subsequently assessed in the EIA and reported in the PEIR.

- Stage 4: individual topics will define the level of detail to be adopted within the assessment through identification of such matters as potential cause and effect relationships between Hornsea Four and other developments and the relative magnitude of impacts from Hornsea Four and other developments that contribute to potential cumulative effects. Cumulative effects will be assessed to different levels of detail depending on the degree of risk involved in the effect and the level of detail available for the other developments (corresponds with Stages 3 and 4 of PINS advice note 17).

- Stage 5: potential impact pathways will be identified for cumulative effects to occur and determining the extent to which Hornsea Four contributes to such impacts and effects (corresponds with Stage 4 of PINS advice note 17). If a receptor is not affected by Hornsea Four or its alternatives, no cumulative effects are anticipated.

- Stage 6: proposed mitigation will be developed for Hornsea Four impacts that contribute to cumulative effects and will take into account measures already identified in the EIA. Where appropriate, additional measures may be identified where practicable to avoid, minimise or reduce the contribution of Hornsea Four impacts to significant cumulative effects. Where appropriate, monitoring may be suggested to deal with uncertainty in conclusions and would be discussed and agreed with consultees and other stakeholders (corresponds with Stage 4 of PINS advice note 17).

8.4.1.3 The assessment of cumulative effects is an iterative process with consultation input on other developments to be screened in and the results of the assessment informing Hornsea Four design and its environmental mitigation.

8.4.1.4 The remainder of this chapter considers the onshore elements of Hornsea Four and other planned projects with which it could have cumulative effects. Stages 1 to 3 of the CEA process described in Section 1.2 are followed in order to identify a short list of other planned projects and their impacts to be assessed in detail post-scoping in the EIA.

8.4.2 Stage 1: Identifying Hornsea Four Impacts with Potential to Contribute to Cumulative Effects and Defining the Zone of Influence

8.4.2.1 To undertake the CEA it is necessary to identify the main impacts from Hornsea Four that have the potential to contribute to cumulative effects together with impacts from other developments. The main impacts will arise during the construction and operation of the substation, construction of the landfall and the construction of the onshore export cable. The assessment team has identified these impacts and effects on environmental / social receptors via this scoping exercise; this process will be further refined as necessary during the subsequent stages of the CEA.

8.4.2.2 The topics and impacts detailed in Table 8-1 have been identified at this early stage as having the potential to contribute to cumulative effects.

Table 8-1 Hornsea Four Impacts with Potential to Contribute to Cumulative Effects

Topic	Potential Impacts
Geology and Ground Conditions	Potential impacts during construction and operation on sensitive sites such as Mineral Safeguarding Areas which other projects also affect, which could lead to cumulative sterilisation of minerals. Potential cumulative effects on receptors due to mobilisation of contaminated sources from Hornsea Four and nearby screened projects. Potential cumulative impacts on localised infiltration rates to groundwater system from hard standing associated with any other schemes within close proximity to the Hornsea Four onshore substation.
Hydrology and Flood Risk Assessment	Potential cumulative impacts from flood risk at the substation site are not considered as flood risk will be managed on site through design.
Ecology and Nature Conservation	During construction, potential cumulative disturbance and temporary habitat loss effects could occur with screened development in close proximity to Hornsea Four activity.
Landscape and Visual Impact	During operation, effects on visual amenity due to inter-visibility of other planned projects with the Hornsea Four substation.

Topic	Potential Impacts
	Cumulative effects during construction are considered less likely to be significant, due to the temporary nature of the activity.
Historic Environment	The Hornsea Four substation and other planned developments could potentially affect the setting of the same scheduled monuments.
Land Use and Agriculture	Cumulative effects during construction are not considered, as it is a temporary activity. Potential cumulative effects with regard to the permanent loss of agricultural land in the substation area.
Traffic and Transport	Cumulative traffic effects are integrally assessed as a matter of course in Transport Assessments by including future growth of traffic flows due to general increase in road use by residents and businesses. This includes committed developments which will be incorporated within the transport modelling and agreed with the relevant highway authority.
Socio-economic Characteristics	Hornsea Four will be set against a background of a variety of economic development activity and in a regional context will likely provide some economic and employment benefits. The socio-economic assessment will consider the contribution of Hornsea Four to the local, regional and national economy to the extent practicable. However, it is not proposed that positive cumulative effects with other plans and proposals are specifically assessed. This is because such benefits are a desired outcome of local, regional and national policies for economic development and Hornsea Four will simply be adding to the benefits provided from other planned development. Potential negative effects on people and human health are considered in the context of other topics (e.g. noise, air quality and traffic).
Noise and Vibration	During construction (all onshore elements) and operation (sub-station only) nearby receptors could be affected by noise from Hornsea Four and from other developments.
Air Quality	Dust generating activities will be managed during construction using standard practices and are therefore considered to not contribute to any cumulative effects.

8.4.2.3 The above impacts have ZOIs taking into consideration the areas / receptors likely to be affected by:

- the Hornsea Four activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of Hornsea Four; and

- effects from unplanned but predictable potential effects caused by Hornsea Four that may occur later or at a different location.

8.4.2.4 The ZoIs are defined by individual topics/impacts and therefore vary. A summary of adopted ZoIs for the purposes of this cumulative effects scoping exercise is provided in Table 8-2.

Table 8-2 Hornsea Four's Zones of influence for the Purpose of Identifying other Development for Inclusion in the Cumulative Effects Assessment

Topic	Zone of Influence
Geology and Ground Conditions	500 m around the scoping boundary is considered for construction impacts.
Hydrology and Flood Risk Assessment	1 km around scoping boundary, to be extended to be extended along watercourses where there may be a hydrological connection.
Ecology and Nature Conservation	500 m radius around the scoping boundary is considered for general construction disturbance impacts on habitats and fauna. Extended for birds and bats to 3 km.
Landscape and Visual Impact	5 km radius from Hornsea Four scoping boundary for low-lying projects (e.g. less than 10-15 m in height). 10 km radius from the scoping boundary as a precautionary basis for potential inter-visibility of tall Hornsea Four substation structures with other tall structures from other planned developments such as proposed onshore wind farms or overhead power lines.
Historic Environment	Limited to the effect on the setting of scheduled monuments and as per landscape and visual (see above).
Land Use and Agriculture	Within the sub-station search area part of the scoping boundary.
Traffic and Transport	Intrinsically considered as part of the Traffic Assessment.
Socio-economic Characteristics	Scoped out
Noise and Vibration	500 m around the scoping boundary. Set as 2 km from the scoping boundary in areas where there is potential for construction night works such as the onshore substation and landfall area, which accounts for uncertainty of substation location and design refinement. 1km around the substation for operation.
Air Quality	Scoped out

8.4.3 Stage 2: Long List of Other Developments Identified with a Zone of Influence Overlapping with Hornsea Four

8.4.3.1 As part of the CEA screening exercise a long list of other developments with the potential to contribute to cumulative effects with Hornsea Four was identified from the following sources:

- East Riding of Yorkshire Planning Portal;
- PINS website including applications at the scoping stage;

- Department for Business, Energy and Industrial Strategy, energy infrastructure portal for Section 36 and Section 37 Electricity Act applications: https://itportal.beis.gov.uk/EIP/pages/recent.htm; and
- request made to the Transport and Works Act Orders Unit at the DfT for Transport and Works Act applications: https://www.gov.uk/government/groups/transport-and-works-act-team..

8.4.3.2 The search for other developments considered the following.

- Taking a precautionary approach it was assumed that other planned projects could have a similar ZOI to Hornsea Four such that cumulative effects could occur with other planned projects that are located up to two times the Hornsea Four ZOI distance from Hornsea Four.

- In order to address potential cumulative landscape and visual impact (and cultural heritage setting effects major applications and EIA development were identified within 10 km (for low lying projects) and 20 km for projects such as onshore wind farms or overhead cables.

- In order to address other topics/impacts other planned developments were identified within 3 km of Hornsea Four from an indicative centreline along the ECC (and within 5km of the substation area).

- Temporally, the search was limited to the five years preceding the submission preparation of this Scoping Report (i.e. from August 2013). Five years was selected as planning permissions typically expire after a period of three to five years (unless an application for extension is permitted), so any permissions from an earlier date are presumed to have elapsed or have been implemented and therefore form part of the baseline.

8.4.3.3 **Figure 8.1** presents the locations of other planned developments onshore following review against the above mentioned criteria. It is worth noting that all the other planned developments are in proximity to the substation with the exception of the Dogger Bank onshore export cable route and landfall. These are also described and screened in Table 8-3.

500000

Proposed Anaerobic Digestion Plant

Lincoln Way Dwellings

Jocks Lodge Highway Improvement Scheme

Lawns Farm Park Battery Storage

A63 Improvement Scheme

N
GRID NORTH

Weel
Walkington
Walkington Wold
Woodmansey
Theame
Dunswell
Kings Grey Legs
Little Weighton
Skidby
Rowley
Eppleworth
Cottingham
New Village
Inglemire
Newland Park
Raywell
Willerby Bottom
North Ella
Kirk Ella
West Ella
Wolfreton
Anlaby Common
East Ella
Anlaby
Anlaby Park
Welton Wold
Swanland
Low Field
Northfield
Hessle
Melton
North Ferriby
West Hill
Redcliff Sand
Bridlington
Driffield
Pocklington
Hornsea
Cottingham
Hedon
Withernsea

A164 A1079 A1174 A1079 A164 A1079 B1233 B1231 B1231 A1105 B1232 A164 A1105 A63 A63 A1079 M62

10km Onshore Zone of Influence

Indicative Dogger Bank Cable Route

430000

430000

Sources: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Contains OS data © Crown Copyright and database right 2018

Name: H4SR_8.1_LocationsOtherDevelopmentsOnshore_A3Por_BNG Date: 08/10/2018 Author: ERM

500000

- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works
- Indicative Dogger Bank Cable Route
- Indicative Location of Dogger Bank Substation
- Creyke Beck Substation
- 10km Onshore Zone of Influence
- A63 Improvement Scheme
- Jocks Lodge Highway Improvement Scheme
- Lawns Farm Park Battery Storage
- Lincoln Way Dwellings
- Proposed Anaerobic Digestion Plant

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:45000

0 0.5 1 1.5 2 Kilometres
0 0.5 1 1.5 Miles

Hornsea Four

Locations of Other Developments Onshore

Figure: 8.1

Document no: H4SR_8.1
Created by: AA
Checked by: CB
Approved by: NL

ERM Ørsted

8.4.4 Stage 3: Screening for Potential Cumulative Effects of Other Projects within the Zone of Influence of Hornsea Four

8.4.4.1 The output of Stage 2 was a long list of approximately 330 other planned developments. These were predominantly small scale (smaller than 2,000 msq), did not require EIA or any other environmental documentation and can be summarised as follows:

- applications for new dwellings (less than 10 units);
- highways improvements;
- extensions to existing dwellings;
- erection of agricultural buildings;
- installation of solar panels for domestic use;
- onshore wind turbines;
- anaerobic digestion plant; and
- battery storage facilities.

8.4.4.2 The majority of other developments of the types listed above are assessed to be of a nature or scale that they do not warrant further consideration in terms of the potential for their impacts to interact with impacts from Hornsea Four and lead to significant cumulative effects on valued receptors and resources. They were therefore screened out. **Annex L** presents the list of other projects that were screened at this stage.

8.4.4.3 The following types of other planned development were also screened out at this stage:

- those that were refused planning permission and are beyond the period for appeal; and
- those that upon closer inspection of the ERYC planning portal and developer websites, appeared to have commenced development and can be assumed to be part of the baseline by the time Hornsea Four commences construction (and this will be reviewed during production of the PEIR).

8.4.4.4 The remaining other planned developments are described in **Table 8-3**, which also presents the results of a screening exercise to determine which types of impact (or EIA topics) are relevant for the other development to be taken forward for more detailed assessment in the CEA. The screening exercise was completed as follows.

- For other developments, a judgement was made by the EIA team of its likely main impacts based on the nature and scale of the development. No judgement was made on magnitude of impact at this stage and this was considered a precautionary approach.

- For each type of impact the other development was screened into or out of the need for further assessment in the CEA based on the separation distance between Hornsea Four and the other development with respect to the ZoI for that type of impact.

8.4.4.5 **Table 8-3** presents the outcome of the process.

Table 8-3 Identifying other Planned Development for further consideration of Cumulative Effects in the EIA

Application	Location	Status	Description	Potential contribution to cumulative effects	Screened in?	Explanation	Distance from Hornsea Four Scoping Boundary (km)
n/a	Land associated with A63 north of Cottingham	Pre-planning, application submission anticipated to be Q4 2018.	A63 Castle Street Improvement-Hull Improvement of a 1.5km stretch of the A63 at Castle Street.	Geology and ground conditions	N	Outside impact zone	7km
				Hydrology and Flood Risk	N	Outside impact zone	
				Disturbance of fauna	N	Outside impact zone	
				Landscape	Y	Within impact zone	
				Cultural heritage setting	Y	Within impact zone	
				Traffic and Transport	Y	Within impact zone	
n/a	Dogger Bank Creyke Beck Onshore Substation Onshore Cable Route	Approved	Dogger Bank Creyke Beck (previously known as Dogger Bank Offshore Wind Farm). The onshore elements of the development will be located in the East Riding of Yorkshire.	Geology and ground conditions	Y	Within impact zone	Various 0-2km
				Hydrology and Flood Risk	Y	Within impact zone	
				Disturbance of fauna	Y	Within impact zone	
				Landscape	Y	Within impact zone	
				Cultural heritage setting	Y	Within impact zone	
				Traffic and Transport	Y	Within impact zone	
17/00920/EIASCR and 17/01193/STPLF	Land South East Of Lawns Farm Park Lane Cottingham	Screening Opinion – Approved Jan 2018	Lawns Farm Park Battery Storage, adjacent to Creyke Beck substation	Geology and ground conditions	Y	Within impact zone	Within 500m
				Hydrology and Flood Risk	Y	Within impact zone	
				Disturbance of fauna	Y	Within impact zone	
				Landscape	Y	Within impact zone	
				Cultural heritage setting	Y	Within impact zone	
				Traffic and Transport	Y	Within impact zone	

Application	Location	Status	Description	Potential contribution to cumulative effects	Screened in?	Explanation	Distance from Hornsea Four Scoping Boundary (km)
15/04027/EIASCR	Land South East Of Bramble Hill Farm Victoria Road	Screening Opinion – Approved Jan 2018	Proposed Anaerobic Digestion Plant	Geology and ground conditions	Y	Within impact zone	Within 500m
				Hydrology and Flood Risk	Y	Within impact zone	
				Disturbance of fauna	Y	Within impact zone	
				Landscape	Y	Within impact zone	
				Cultural heritage setting	Y	Within impact zone	
				Traffic and Transport	Y	Within impact zone	
18/01846/EIASCR	A164 and Jocks Lodge Highway	Screening Opinion – Enquiry Answered	Jocks Lodge Highway Improvement Scheme	Geology and ground conditions	Y	Within impact zone	0m-1km
				Hydrology and Flood Risk	Y	Within impact zone	
				Disturbance of fauna	Y	Within impact zone	
				Landscape	Y	Within impact zone	
				Cultural heritage setting	Y	Within impact zone	
				Traffic and Transport	**Y**	Within impact zone	
15/03764/STPLF 16/30261/CONDET 17/30011/CONDET 17/30611/CONDET	Land West Of Lincoln Way Beverley	Approved	Lincoln Way Dwellings: Erection of 100 dwellings with access to Lincoln Way, associated infrastructure and open space.	Geology and ground conditions	Y	Within impact zone	Within 500m
				Hydrology and Flood Risk	Y	Within impact zone	
				Disturbance of fauna	Y	Within impact zone	
				Landscape	Y	Within impact zone	
				Cultural heritage setting	Y	Within impact zone	
				Traffic and Transport	Y	Within impact zone	

8.5 Conclusions

8.5.1 Offshore CEA

8.5.1.1 Section 1.3 has set out the proposed approach to the offshore CEA for Hornsea Four, following the approach set out in the PINS Advice Note 17 and relevant Renewables UK guidance developed for offshore renewables projects.

8.5.1.2 Consultees are invited to consider the proposed approach described in Section 1.3 and respond to the following questions:

- Is the proposed approach to the offshore elements of the Hornsea Four CEA acceptable given that it applies the approach set out in PINS Advice Note 17, amended to include the consideration of operational projects in Tier 1 (either where they were not operational when the baseline was collected or may have an ongoing impact in the operational phase)?

- Are there any specific developments or data sources that should be considered in the CEA?

8.5.2 Onshore CEA

8.5.2.1 The screening process in Section 8.4 has considered the potential for cumulative effects, screened out certain other development from further consideration in the CEA and has identified a number of other onshore projects and types of impact which will be examined in more detail at the topic level as the CEA and EIA proceed. Other projects may be screened out/scoped in as Hornsea Four is refined and the EIA proceeds.

8.5.2.2 Consultees are invited to consider the information provided in Section 1.4 and to advise on whether they agree with the conclusions in terms of the following.

- Are there any other developments that should be included in the onshore CEA? and if so please explain why.

- Are there any potential impacts resulting from Hornsea Four that could contribute to cumulative effects with other developments which have not been identified and if so please explain why?

9 Summary and Next Steps

9.1 Overview

9.1.1.1 The information included in the Scoping Report is provided to support the Applicant's request for a Scoping Opinion from the SoS in relation to the development of Hornsea Four. Hornsea Four will have a generating capacity of greater than 100 MW and is therefore a NSIP defined by Section 15(3) of the Planning Act 2008. As such, there is a requirement to submit an application for Development Consent to PINS.

9.1.1.2 The Scoping Report is intended to support engagement with PINS and statutory consultees in the EIA process, inviting them to provide relevant information and to comment on the proposed approach to the EIA, to ensure that a robust and proportionate EIA is undertaken. This Scoping Report has identified the main aspects of the offshore and onshore environment likely to be significantly affected by the construction, operation and decommissioning of Hornsea Four. For each of these identified aspects, the Scoping Report has identified the extent of relevant environmental studies to be undertaken as part of an EIA. The ES will outline the full EIA and will be submitted alongside the application for Development Consent.

9.1.2 Summary of Scoped-Out Impacts

9.1.2.1 Potential impacts of Hornsea Four have been identified according to each EIA topic area. For some of these potential impacts, further data collection and an assessment will be required in order to determine the significance of their effects. These impacts have been scoped-in and an appropriate level of assessment (i.e. simple or detailed) has been proposed.

9.1.2.2 For other potential impacts it is proposed that they be scoped-out of the EIA (i.e. no further data collection or assessment is proposed) based on an understanding of the nature of the development, the route planning and site selection process, the available evidence base, the mitigation measures adopted as part of the project and the context of the baseline environment.

9.1.2.3 Those impacts that have been scoped-out are summarised in **Table 9-1**.

Table 9-1 Summary of Impacts to be Scoped-Out of the EIA

EIA Topic	Construction	Operation & Maintenance	Decommissioning
Offshore			
Marine Geology, Oceanography and Physical Processes	• Changes to sediment pathways.	• Scouring around foundations.	• Changes to sediment pathways.
Benthic and Intertidal Ecology	• Temporary habitat disturbance in the Hornsea Four array area and offshore ECC from construction activities. • Temporary habitat disturbance in the intertidal area from cable installation. • Temporary increase in SSC and sediment deposition in the Hornsea Four array area and offshore ECC. • Temporary increase in SSC and sediment deposition in the intertidal area. • Impacts on benthic ecology from noise arising from foundation installation. • Direct and indirect seabed disturbances leading to the release of sediment contaminants. • Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	• Long-term habitat loss/ change from the presence of foundations, scour protection and cable protection. • Colonisation of the WTGs and scour/ cable protection may affect benthic ecology and biodiversity. • Increased risk of introduction or spread of MINNS due to presence of subsea infrastructure and vessel movements (e.g. ballast water) may affect benthic ecology and biodiversity. • Direct disturbance to seabed from jack-up vessels and cable maintenance activities. • Indirect disturbance to benthic species from EMF generated by inter-array and export cables. • Changes to seabed habitats arising from effects on physical processes, including scour effects and changes in the sediment transport and wave regimes resulting in potential effects on benthic communities.	• Temporary habitat disturbance from removal of foundations and cables. • Increased SSC and sediment deposition from removal of foundations and cables. • Loss of introduced habitat from the removal of foundations. • Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.

EIA Topic	Construction	Operation & Maintenance	Decommissioning
		• Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	
Fish and Shellfish Ecology	• Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from construction activities. • Temporary localised increases in SSC and smothering. • Direct and indirect seabed disturbances leading to the release of sediment contaminants. • Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors.	• Long-term loss of habitat due to the presence of turbine foundations, scour protection and cable protection. • Increased hard substrate and structural complexity as a result of the introduction of turbine foundations, scour protection and cable protection. • Underwater noise as a result of operational turbines. • EMF effects arising from cables. • Direct disturbance resulting from maintenance during operation. • Indirect disturbance resulting from the accidental release of pollutants. • Potentially reduced fishing pressure within the Hornsea Project 4 array area and increases fishing pressure outside the array area due to displacement.	• Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from decommissioning activities. • Temporary localised increases in SSC and smothering. • Direct and indirect seabed disturbances leading to the release of sediment contaminants. • Mortality, injury, behavioural changes and auditory masking arising from noise and vibration. • Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors.
Marine Mammals	• TTS from piling noise. • Reduction in prey ability. • Reduction in foraging ability. • Toxic contamination. • Construction of landfall: Disturbance to seal haul-outs. • TTS from UXO clearance.	• Operational noise • Reduction in prey availability • Reduction in foraging ability • Toxic contamination • EMF	• TTS from underwater noise. • Reduction in prey availability. • Reduction in foraging ability. • Toxic contamination.
Offshore and Intertidal Ornithology	• Indirect impacts during the construction phase within the array area through effects on habitats and prey species.	• Indirect impacts within the array area during the operational phase through effects on habitats and prey species.	• Indirect impacts during the decommissioning phase within the offshore export cable

EIA Topic	Construction	Operation & Maintenance	Decommissioning
		• Potential for ad-hoc maintenance of export cable throughout operational phase, which may lead to disturbance and displacement of species within the export cable corridor and different degrees of buffers surrounding it. • Potential for ad-hoc maintenance of export cable through the intertidal zone during the operational phase may lead to disturbance and displacement of waterbird species in close proximity to the works.	corridor and landfall through effects on habitats and prey species.
Marine Archaeology	• Removal of sediment containing undisturbed archaeological contexts leading to total loss of the receptor during preparation of the seabed for WTG and offshore substation foundations. • Intrusion of piling foundations disturbing or destroying archaeological receptors. • Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and wind turbine. • Disturbance of sediment containing potential archaeological receptors (material and contexts) during inter-array cable laying operations. • Disturbance of sediment containing potential archaeological receptors (material and contexts) during export cable laying operations. • Penetration and compression effects of jack-up barges and anchoring of construction	• All impacts are scoped in for further assessment	• Penetration and compression effects of jack-up barges and anchoring of decommissioning vessels leading to total or partial loss of archaeological receptors (material or contexts).

EIA Topic	Construction	Operation & Maintenance	Decommissioning
	vessels during turbine, sub-station or cable installation leading to total or partial loss of archaeological receptors (material or contexts).		
Commercial Fisheries	• Hornsea Four array area and offshore cable corridor construction activities leading to displacement or disruption of commercially important fish and shellfish resources. • Hornsea Four array area and Hornsea Four offshore cable corridor construction activities leading to additional steaming to alternative fishing grounds for vessels that would otherwise be fishing within the array and export cable areas. • Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting construction vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor leading to interference with fishing activity. •	• Hornsea Four operation and maintenance activities leading to displacement or disruption of commercially important fish and shellfish resources. • Physical presence of the Hornsea Four array area and export cable leading to additional steaming to alternative fishing grounds for vessels that would otherwise be fishing within the Hornsea Four array area and offshore cable corridor. • Increased vessel traffic within fishing grounds as a result of changes to shipping routes and maintenance vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor infrastructure leading to interference with fishing activity.	• Decommissioning activities leading to displacement or disruption of commercially important fish and shellfish resources. • Decommissioning activities leading to longer steaming distances to alternative fishing grounds. • Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting decommissioning vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor leading to interference with fishing activity.
Shipping and Navigation	• All impacts are scoped in for further assessment.	• All impacts are scoped in for further assessment. •	• All impacts are scoped in for further assessment.
Aviation and Radar	• WTG effects on civil and military radar systems during construction process • WTG commissioning/ decommissioning infrastructure may present physical obstruction effects on civil and military flight operations (including military Low Flying activity).	• Under aviation flight rules, the MSA is the altitude below which it is unsafe to fly in IMC (i.e. in poor visibility/cloud) owing to presence of terrain or obstacles within a specified area.	• WTG commissioning/decommissioning infrastructure may present physical obstruction effects on civil and military flight operations (including military Low Flying activity). • WTG and their commissioning/decommissioning

EIA Topic	Construction	Operation & Maintenance	Decommissioning
	• WTG and their commissioning/ decommissioning infrastructure may present a physical obstruction and affect SAR helicopter flight operations. The development will lead to a change of the operating environment should an airborne SAR operation be required within or close to the array area. • There is expected to be a requirement for Aviation Obstruction Lighting on the construction and decommissioning infrastructure and all or individual WTG based on CAA regulations. The fitting of appropriate lighting would ensure conspicuity of the WTG and infrastructure to stakeholders.		infrastructure may present a physical obstruction and affect SAR helicopter flight operations. The development will lead to a change of the operating environment should an airborne SAR operation be required within or close to the array area. • There is expected to be a requirement for Aviation Obstruction Lighting on the construction and decommissioning infrastructure and all or individual WTG based on CAA regulations. The fitting of appropriate lighting would ensure conspicuity of the WTG and infrastructure to stakeholders.
Seascape and Visual Resources	• Offshore construction activities visible by day and night from offshore visual receptors • Offshore construction activities alter present day seascape character through physical and visual changes to the present-day seascape character. • Offshore construction activities alter historic seascape character through physical changes to it. • Offshore construction activities cumulatively alter the visual resource and seascape character through changes (by day and night) to the seascape in the context of other offshore development.	• Offshore HVAC booster substations and Array Area visible by day and night from offshore visual receptors. • Offshore HVAC booster substations and Array Area alter seascape character through changes to the present-day seascape character. • Offshore HVAC booster substations and Array Area alter seascape character through changes to the characteristics of the historic seascape character. • Offshore HVAC booster substations and Array Area cumulatively alter the visual resource and seascape character through changes to the seascape in the context of other offshore development.	• Offshore decommissioning activities visible from offshore visual receptors. • Offshore decommissioning activities alter seascape character through changes to the present-day seascape character. • Offshore decommissioning activities alter seascape character through changes to the characteristics of the historic seascape character. • Offshore decommissioning activities cumulatively alter the visual resource and seascape character through changes to the seascape in the context of other offshore development.

EIA Topic	Construction	Operation & Maintenance	Decommissioning
Infrastructure and Other Users	• Aggregate dredging activities. • Disposal sites. • Impacts on the proposed Endurance CCS site. • Impacts on existing or proposed pipelines or cables or restrictions on access to pipelines or cables.	• Aggregate dredging activities. • Disposal sites. • Impacts on the proposed Endurance CCS site. • Temporary loss of access to existing or proposed pipelines or cables for repair or maintenance.	• Aggregate dredging activities. • Disposal sites. • Impacts on the proposed Endurance CCS site • Impacts on existing or proposed pipelines or cables or restrictions on access to pipelines or cables.
Socio-economic characteristics	• Impacts on individual and community / population cohesion. • Impacts on family cohesion. • Impacts on cultural maintenance. • Impact on value of alternative land uses (e.g. tourism vs. fishing vs. industry) • Impacts on maintenance of traditional language, education, laws and traditions. • Avoidance of boom and bust cycles. • Cause or exacerbate in- and out-migration effects. • Cause changes in social and cultural makeup of affected communities. • Pressure on social services such as health care, education and justice • Cause or exacerbate housing pressures, e.g. affordability, availability and appropriateness • Impact on the local and regional cost of living? • Lead to adverse lifestyle changes, e.g. increased gambling, crime, substance abuse.		

9.1.3 Inter-related Effects

9.1.3.1 The inter-related effects assessment considers the likely significant effects of multiple impacts from the proposed development on one receptor. An initial screening exercise has been undertaken to identify possible inter-related effects for Hornsea Four. This screening exercise is presented in **Annex L** of this Scoping Report.

9.1.4 Transboundary Impacts

9.1.4.1 A screening assessment of potential transboundary impacts arising from Hornsea Four which have the potential to affect other EEA states has been completed and presented within **Annex K** of this Scoping Report. This screening has been carried out in accordance with PINS Advice Note 12. On the basis of the current information available, transboundary impacts have been screened into the EIA process for the following topics:

- Fish and Shellfish Ecology;
- Marine Mammals;
- Ornithology;
- Commercial Fisheries
- Shipping and Navigation; and
- Aviation and Radar.

9.1.5 Water Framework Directive

9.1.5.1 A WFD Stage 1 screening assessment has been completed and presented within **Annex E** of this Scoping Report. The screening assessment considered relevant water bodies, protected areas, and bathing and shellfish waters that could be potentially affected by the Hornsea Four. The following have been screened in and will be addressed in the PEIR:

9.1.5.2 Water bodies:

- Yorkshire South water body (GB640402491000)

9.1.5.3 Protected areas:

- Flamborough Head SAC
- Flamborough Head and Bempton Cliffs SPA
- Greater Wash SPA

9.1.5.4 Bathing waters:

- Bridlington South Beach
- Wilsthorpe
- Fraisthorpe
- Skipsea

9.1.6 Marine Conservation Zone Screening

9.1.6.1 A preliminary initial screening of designated MCZs, which it is proposed are carried forward for consideration in the Stage 1 MCZ Assessment, has been completed and presented within the Scoping Report (**Annex F**). It is currently anticipated that the following designated MCZ and rMCZs will be carried forward for the Stage 1 MCZ Assessment:

- Holderness Inshore MCZ– The offshore ECC overlaps with this MCZ; and
- Holderness Offshore rMCZ – The offshore ECC overlaps with this rMCZ.

9.1.7 Consultation

9.1.7.1 Before an application for a DCO is submitted to PINS, extensive consultation with key stakeholders (local authorities, statutory bodies, the local community and interest groups) is required. Hornsea Four will undertake this consultation according to a series of phases. Hornsea Four has produced this Scoping Report as part of its first phase of consultation. A Scoping Opinion, coordinated by PINS, will result in feedback will be fed into the ongoing EIA process for the development. In parallel to the Scoping Opinion, Hornsea Four will also hold a number of public consultation events within ERYC between 22 October and 27 October 2018.

9.2 Next Steps

9.2.1.1 Once the Scoping Opinion has been obtained from the Planning Inspectorate, preparations will be made for both the formal pre-application consultation stage under Sections 42 and 48 of the Planning Act 2008. The EIA and Hornsea Four design will proceed with envelope refinement, further assessment and analysis. A PEIR will be produced and consulted on in spring 2019. The PEIR will provide an initial statement of the environmental information available for the Hornsea Four study area, including descriptions of the likely environmental effects and mitigation measures adopted as part of the Hornsea Four development. The PEIR is intended to allow those taking part in the consultation to understand the nature, scale, location and likely significant environmental effects of Hornsea Four, such that they can make an informed contribution to the process of pre-application consultation under the Planning Act 2008 and to the EIA process. Consultation will also be undertaken with the local community in accordance with Section 47 of the Planning Act. A Statement of Community Consultation (SoCC) has been developed which sets out the types and likely dates of consultation and engagement.

9.2.1.2 A website has been developed to provide information and updates on the Hornsea Four project, and matters relating to the proposed application: www.hornseaprojects.co.uk/hornsea-project-four/

9.2.1.3 A draft table of contents for the PEIR is provided in **Table 9-2**. The mandatory requirements for the content of an ES are set out in Regulation 14 (2) supplemented by Schedule 4 of the 2017 EIA Regulations. Specific requirements under the Schedule 4 and where they will be addressed in the PEIR are set out in **Table 9-3**. Regulation 14 (3) (a)

requires that an ES "be based on the most recent scoping opinion adopted"; the PEIR will set out clearly how the matters raised in the scoping opinion have been addressed. Regulation 14 (3) (b) requires that the ES "include the information reasonably required for reaching a reasoned conclusion on the significant effects of the development on the environment, taking into account current knowledge and methods of assessment". The PEIR will include such information and set out the methods of assessment. Regulation 14 (3) (c) requires that the ES "be prepared, taking into account the results of any relevant UK environmental assessment, which is reasonably available to the applicant with a view to avoiding duplication of assessment." A cornerstone of the proportionate approach to the PEIR and ES is to take into account the accepted results of other environmental assessments as part of the evidence base. Regulation 14 (4) refers to the competence of those involved in undertaking the EIA. The PEIR will set out in brief in its Introduction the persons and organisations involved and their relevant qualifications.

9.2.1.4 The Applicant plans to further refine Hornsea Four based upon the consultation responses received from the PEI process. The final results of the EIA will be presented in an ES and a summary of all consultation responses received will be presented in a Consultation Report, both of which will accompany the DCO application.

Table 9-2 Provisional Structure of PEIR Volume I

Chapter	Title
	Non-technical Summary
1	Introduction
2	Policy and Legislative Context
3	Route Planning and Site Selection
4	Project Description
5	EIA Methodology
6	Consultation
7	Marine Geology, Oceanography and Physical Processes
8	Fish and Shellfish Ecology
9	Marine Mammals (supported by a Marine Noise Technical Annex)
10	Offshore and Intertidal Ornithology
11	Marine Archaeology
12	Commercial Fisheries
13	Shipping and Navigation
14	Aviation and Radar
15	Seascape and Visual Resources
16	Infrastructure and Other Users
17	Geology and Ground Conditions
18	Hydrology and Flood Risk
19	Ecology and Nature Conservation
20	Landscape and Visual
21	Historic Environment
22	Land Use and Agriculture
23	Traffic and Transportation

24	Noise and Vibration
25	Socioeconomic Characteristics
26	Summary of Cumulative and Transboundary Effects

Table 9-3 EIA Requirements and where they will be addressed in the PEIR

Topic	Potential Impacts
Required information under Schedule 4 of the 2017 EIA Regulations	Reference to how this matter will be addressed in the PEIR (and ES)
Paragraph 1 of Schedule 4 A description of the development, including in particular: (a)a description of the location of the development; (b)a description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases; (c)a description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used; (d)an estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced during the construction and operation phases.	Chapter 5 of the PEIR will provide a description of all aspects of the Project, including mitigation measures that Hornsea Four has committed to. Each technical topic chapter will contain relevant information setting out how it has considered the project in the context of a realistic worst case scenario (Rochdale envelope approach).
Paragraph 2 of Schedule 4 A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Chapter 4 of the PEIR will provide an account of the route planning and site selection exercise, including a description of the selected options and reasonable alternatives studied by Hornsea Four, a comparison of environmental effects and the rationales for decision-making for the chosen options and reasons for why alternatives were rejected. Where relevant, further consideration of alternatives (e.g. for mitigation options) will be made for each technical topic in the relevant chapters.
Paragraph 3 of Schedule 4 A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the	The technical topic chapters will each contain more extensive topic-specific descriptions of existing conditions and how they might evolve over the Hornsea Four lifetime, with particular emphasis on any aspects which by virtue

Topic	Potential Impacts
baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.	of changing over the Hornsea Four lifetime could experience (or cause) different effects from those predicted for the current baseline.
Paragraph 4 of Schedule 4 A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.	The technical topic chapters will each contain topic-specific descriptions of existing conditions. These will highlight valued aspects of the receiving environment and focus especially on those features that could be significantly affected by Hornsea Four. A stand-alone chapter for human health is not envisaged; however, potential effects on human health will be comprehensively assessed in technical topics addressing noise, air quality and traffic.
Paragraph 5 of Schedule 4 A description of the likely significant effects of the development on the environment resulting from, inter alia: a) the construction and existence of the development, including, where relevant, demolition works; b) the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources; c) the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste; d) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters); e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;	The technical topic chapters will describe and assess the likely significance of effects for each technical topic. Cumulative effects will be addressed in each of these chapters (according to the methodology set out in this Scoping Report) and will be summarised, along with any indirect effects, in Chapter 27 of the PEIR. As a renewable energy project it is not envisaged that Hornsea Four will have any significant effects on climate; however, the PEIR will set out the benefits that Hornsea Four will deliver in terms of reduced greenhouse gas emissions compared with a fossil fuel-fired electricity generation project. The vulnerability of the project to climate change (e.g. flood risk, coastal erosion, increased storminess) will be assessed in relevant technical topics and a flood risk assessment. Measures to counter climate change risks will be described in the Project Description chapter of the PEIR.

Topic	Potential Impacts
f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change; g) the technologies and the substances used. The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project, including in particular those established under Council Directive 92/43/EEC and Directive 2009/147/EC.	
Paragraph 6 of Schedule 4 A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.	The overall approach to the EIA is described in Chapter 5 of this Scoping report and in Chapter 6, Chapter 7 and **Annex C** with respect to the individual technical topics. Each technical topic chapter of the PEIR will contain a section setting out the topic-specific methodology, including forecasting and modelling methods and evidence used. Uncertainty and related matters and how they have been dealt with will also be considered in the PEIR for each topic in its technical topic chapter where relevant.
Paragraph 7 of Schedule 4 A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are	Certain items of inherent (primary) mitigation will be described in the project description in Chapter 5 of the PEIR. Tertiary mitigation measures, typically in the form of management plans will be provided in annexes to the PEIR and referenced where appropriate in the technical topic chapters

Topic	Potential Impacts
avoided, prevented, reduced or offset, and should cover both the construction and operational phases.	Secondary mitigation measures specific to particular topics will be described in the relevant technical topic chapters. Mitigation measures including any monitoring will also be summarised in the form of a 'register' in Annex B, together with how they will be secured and their means of delivery.
Paragraph 8 of Schedule 4 A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or UK environmental assessments may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.	Where it is relevant to do so individual topic chapters will provide assessments of the potential effects arising from accident scenarios and the control measures to address these. A stand-alone chapter is not proposed.
Paragraph 9 of Schedule 4 A non-technical summary of the information provided under paragraphs 1 to 8.	The PEIR will be prefaced by a Non-technical Summary.
Paragraph 10 of Schedule 4 A reference list detailing the sources used for the descriptions and assessments included in the environmental statement.	Key sources of information will be described in a specific sub-section of each of the technical topic chapters. In addition other sources of information, including cited literature sources and links to websites will be provided as bibliographies throughout the PEIR. Primary data collected for the EIA (e.g. by survey) will be provided in annexes to the PEIR.

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Environmental Impact Assessment: Scoping Report

Annex A Impacts Register

Table A 1.1 below presents the Geology and Ground Conditions Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.1 Geology and Ground Conditions Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
Damage to the coastline and impacts on coastal erosion: construction phase Trenchless techniques (i.e. HDD) will be used for the landfall construction	Design: see Project description	Negligible	Medium	**No likely significant effects.** The use of trenchless techniques will avoid effects on the integrity of the cliff including any changes in the current coastal erosion regime.	Scoped out Effects avoided, no further assessment required.	Baseline data will be reviewed to provide input to the engineering design, but this activity will not be assessed in the PEIR. Data sources include: • BGS data; • available site investigations; and • online information on coastal mitigation in the area.
Damage to designated geological SSSIs: construction phase Any ground breaking activities that directly overlap with them could affect geological designated SSSIs.	Co2	No change or Negligible	High	**No likely significant effects.** Whilst the scoping assessment has identified two SSSIs, these features will be avoided as part of the routeing.	Scoped out Effects avoided, no further assessment required.	N/A
Sterilisation of future mineral resources: operational phase Where overlaps occur between the permanent ECC and regional geological sites and/or minerals safeguarding areas this could sterilise future resources.	Co2, Co7, Co10	Small, potentially medium	Medium/High	**Likely significant effects without secondary mitigation.** The RPSS exercise seeks to avoid regional geological sites and minerals safeguarding areas and has already avoided several, however in some cases (at least the three areas which span the 700 m ECC) this may not be.	Scoped in. Simple assessment approach will be adopted involving site walkover and baseline review. Consultation with ERYC to minimise impacts on the minerals safeguarding areas.	Baseline data review to include identification of regional geological sites and planned minerals safeguarding areas. Data sources include: • BGS data • ERYC
Exposure of workforce to health impacts: construction phase Construction activities (all project components), such as trenching, excavations and other earthworks could disturb contaminants where present, which could result in health risks to construction workers	Co76	Negligible	High	**No likely significant effects.** Pathway between receptor and source will be avoided through use of PPE.	Scoped out No further assessment required. Protective measures will be described in a CoCP.	N/A
Encountering contamination during intrusive works: construction phase Construction activities (all project components), such as trenching, excavations and other earthworks could disturb contaminants, which could result in impacts on soil / land use; and pollution of groundwater.	Co77	Small, potentially medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** Areas of potential contamination exist, some of which will be avoided as the route planning and site selection proceed. However some may be unavoidable and a residual risk of encountering contamination will remain.	Scoped in A simple assessment approach will be adopted involving site walkover and baseline review of potential sources, pathways and receptors. This will feed into the development of a risk-based approach to managing potential contaminated soils during all aspects of construction.	Baseline data review to include identification of geology, hydrogeology and potential sources of contamination. Data sources to include: • BGS data • Envirocheck data • Local authority data • Available site investigation reports. • Available site investigation reports.
Soil compaction: construction phase Construction vehicle movements and the creation of haul routes could cause compaction of the subsoil, which would degrade soil quality.	Co64, Co10	Negligible	Likely to range from low to high	**No likely significant effects.** Standard industry practices for the protection of top and subsoils during construction and their reinstatement post construction will avoid compaction impacts	Scoped Out No further assessment required. Vulnerable soils and their locations will be described and protective and reinstatement measures will be described in a soils management plan or similar.	Baseline data review to include identification of different soil classes and their characteristics and vulnerability to compaction. Data sources to include: • BGS data • Envirocheck data • Local authority data • Available site investigation reports.
Dewatering of trenches and excavations: construction phase If required, dewatering perched water or groundwater could reduce groundwater flow and affect water quality and base flow of local watercourses and abstractions.	N/A	Small	Likely to range from low to high	**Likely significant effects without secondary mitigation** At this stage the nature and value of the water resource is yet to be fully established.	Scoped in Simple assessment approach will be adopted involving survey, where necessary, and baseline review together with development of location-specific mitigation.	Baseline data review to include identification of hydrogeology. Data sources to include: • BGS data; • Envirocheck data; • Local authority data; • Available site investigation reports.
Physical intrusion into groundwater resource: construction phase Installation of foundations, ground preparation and associated activities for the onshore substation could lead to potential contamination of underlying groundwater resources.	Co77	Small, potentially medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** At this stage, the nature of the water resource is yet to be fully established in relation to where such works will occur	Scoped in Simple assessment approach will be adopted involving baseline review of potential sources, pathways and receptors, but with embedded mitigation measures, assumed to be rated at most, a minor effect.	Baseline data review to include identification of geology, hydrogeology and potential sources of contamination. Data sources to include: • BGS data; • Envirocheck data; • Local authority data; • Available site investigation reports.
Accidental spills: construction and operation phase During both construction and operation, there exists the potential for accidental oil / fuel / hazardous substance spills from vehicles, contaminative equipment, storage containers / tanks and during maintenance operations (e.g. lubrication of electrical equipment). to contaminate the ground and groundwater, impacting the quality of local groundwater resources	Co22	Negligible	Likely to range from low to high	**No likely significant effects.** Whilst the scoping assessment has identified potential contaminative sources introduced by the construction and operation of Hornsea Four, embedded tertiary mitigation will be in place to avoid significant effects.	Scoped out No further assessment required. The CoCP will set out preventative measures and contingency plans.	N/A
Changes to current drainage and water infiltration to ground at the substation site: operational phase Operational footprint of the onshore substation site could lead to a reduction in local groundwater infiltration rates, which would affect both quality and quantity of the resource.	Co22 Design in accordance with widely accepted guidance on sustainable urban drainage systems (SUDS)	Negligible	Likely to range from low to high	**No likely significant effects** SUDS design includes provision for maintaining infiltration rates to ground and greenfield run-off rates.	Scoped out: The Project Description will set out the SUDS design principles for the substation	Baseline data review to include estimate of current infiltration and greenfield run-off rates. Data sources to include: • BGS data; • Envirocheck data; • Available site investigation reports; • Substation FRA.
Thermal impacts on groundwater: operational phase Thermal effects of the underground power cables along the cable route corridor during operation could lead to potential impacts on groundwater quality and associated species / habitats. Reduction in WFD status.		Medium	Likely to range from low to high	**Likely significant effects without secondary mitigation.** At this stage the nature of the water resource is yet to be fully established.	Scoped in Simple assessment approach will be adopted involving baseline review of the groundwater units / existing water quality and future WFD status.	Baseline data review to include identification of geology, hydrogeology. Data sources to include: • BGS data; • Envirocheck data; and • Available site investigation reports.
Decommissioning						
The impacts during decommissioning will be similar, and potentially less than outlined for the construction phase for the substation. Based on leaving the underground cable in situ there will be no effects along the ECC .						

Table A 1.2 below presents the Hydrology and Flood Risk Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.2 Hydrology and Flood Risk Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	AnticipatedImportance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple of Detailed)	Further Baseline Data Requirements
Coastal erosion at the landfall: Construction phase Works associated with crossing the landfall by HDD may lead to increased rates of coastal erosion and associated flood risk from the sea.	Primary Co1 Tertiary Co10	No Change	High	**No likely significant effects.**	Scoped out	N/A
Disturbance of watercourses: Construction phase Works associated with cable crossings Main Rivers and IDB maintained watercourses may result in a reduction in water quality and channel hydro-morphology.	Primary Co1 Co80	No Change	High	**No likely significant effects.**	Scoped out	Development of the water course crossing schedule and agreement of crossing methodology with EA, IDB and LLFA.
Access across watercourses: **Construction phase** Works associated with access track crossings of Main Rivers and IDB maintained watercourses may result in a reduction in water quality and channel hydro-morphology.	Access routes will be designed to avoid high value watercourses. Where avoidance is not possible, baily bridges, or other crossing structures may be required on a temporary basis.	Small	High	**Negligible / Minor – No likely significant effects.** Any structures that are required to be constructed across watercourses will be subject to appropriate permits from the EA / LLFA.	Scoped in A simple assessment approach will be adopted involving an assessment of the likely physical impacts on the channel banks, and riparian vegetation.	Development of the water course crossing schedule and agreement of crossing methodology with EA, IDB and LLFA.
Disturbance of minor drainage ditches: Construction phase Works associated with cable crossings of minor drainage ditches (as defined in the watercourses crossing schedule and agreed with EA, IDB and LLFA) may result in a reduction in water quality and channel hydro-morphology.	Primary Co34 Co80	Small	Low – Medium	**No likely significant effects.**	Scoped out	Development of the water course crossing schedule and agreement of crossing methodology with EA and other stakeholders
Access across minor drainage ditches: Construction phase Works associated with access track crossings of minor drainage ditches (as defined in the watercourses crossing schedule and to be agreed with EA, IDB and LLFA) may result in a reduction in water quality and channel hydro-morphology.	Access routes will be designed to avoid watercourses where possible. Where avoidance is not possible, baily bridges, or other crossing structures may be required on a temporary basis.	Small	Low – Medium	**No likely significant effects.**	Scoped out	Development of the water course crossing schedule and agreement of crossing methodology with EA and other stakeholders
Disruption of local land drainage: **Construction phase** Works associated with cable installation leading to impacts on the integrity of the local land drainage systems and potential flooding.	Primary Co25 Tertiary Co10 Co64	Negligible	Likely to range from low to high	**No likely significant effects.**	Scoped out	N/A
Changes in water quality: **Construction phase** Works associated with cable installation leading to impacts on the water quality of watercourses and drainage systems local to the works.	Primary Co25 Co34 Tertiary Co64	Negligible	Likely to range from low to high	**No likely significant effects.**	Scoped out	N/A
Alteration in run-off characteristics at substation site: **Operation phase** The operational presence of the substation may alter surface run-off characteristics from the site and could lead to increased flood risk elsewhere.		Small to Medium	Low to Very High	**Likely significant effect without secondary mitigation** Increase in flood risk from surface water has the potential to affect the substation itself, and increase flood risk to sensitive receptors downstream which could have a significant effect if not mitigated.	Scoped in A simple assessment will be undertaken to inform the formal Flood Risk Assessment. This will include details of the proposed drainage strategy that will show how surface water will be attenuated within the order limits.	Design and layout of proposed substation, including areas of hardstanding and permeability. Calculations of baseline and new run-off rates. Development of indicative drainage strategy.
Mobilisation of pollutants in the event of disturbance of contaimnated soils: **Construction phase** Works associated with construction of the cable and substation may mobilise contaminants into surface water run-off from the site.	Primary Co25 Co34 Tertiary Co64	Negligible	High	**No likely significant effects.**	Scoped out	N/A
Decommissioning phase Works associated with decommissioning of the cable	Buried cables will be de-energised with the ends sealed and left in place to avoid ground disturbance.	Negligible	High	**No likely significant effects.**	Scoped out	N/A
Decommissioning phase Works associated with decommissioning of substation	Decommissioning practices will incorporate measures to prevent pollution, to include emergency spill	Negligible	High	**No likely significant effects.**	Scoped out	N/A

Table A 1.3 below presents the Ecology and Nature Conservation Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.3 Ecology and Nature Conservation Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Direct impacts on designated sites: **Construction phase** Temporary construction areas could occupy areas leading to loss and/or degradation of designated sites.	Primary Co1 Co2 Co7 Co26 Tertiary Co114	None	Low to high	**No likely significant effect**	Scoped out	N/A
Impacts on non-designated sites: **Construction phase** Construction compounds, access roads and other infrastructure will temporarily occupy areas leading to loss and/or degradation of non-designated habitat.	Primary Co1 Co2 Co7 Co26 Tertiary Co114	Medium	Range from low to high	**Potentially significant without secondary mitigation** Habitats could be temporarily lost, damaged or degraded as a result of construction activities.	Scoped in A simple assessment approach will be adopted which will include identification of features via Phase 1 Habitat survey results to feed into location-specific restoration and reinstatement measures.	N/A Phase 1 Habitat survey complete Standard hedgerow survey techniques in accordance with Natural England requirements of representative habitat affected by Hornsea Four.
Impacts on bat species: **Construction phase** Construction activities will temporarily occupy areas leading to loss and / or degradation of habitat and loss of habitat connectivity used by bats for roosting, commuting and / or foraging.	Primary Co2 Co26 Co36 Tertiary Co123	Range from small to medium	Range from low to high	**Potentially significant without secondary mitigation** Bat roosts and bat commuting and / or foraging habitat could be temporarily lost, damaged or degraded as a result of construction activities. Roosting, commuting and foraging bats could be disturbed by light, vibration and other activities associated with construction.	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of confirmed bat roosts and any key commuting and / or foraging areas used by bats. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. use of directional lighting during night work).	Standard bat survey techniques in accordance with Natural England requirements of areas of habitat with moderate or high potential for bat roosts and / or commuting and / foraging habitat.
Impacts on breeding and / or wintering bird species: **Construction phase** Construction activities will temporarily occupy areas leading to loss and / or degradation of habitat and loss of habitat connectivity used by breeding and / or wintering birds.	Primary Co2 Co7 Co26	Range from small to medium	Range from low to high	**Potentially significant without secondary mitigation** Breeding and wintering bird habitat could be temporarily lost, damaged, severed/ fragmented or disturbed as a result of construction activities. Nesting birds could be disturbed by increases in personnel on site, noise, vibration and other activities associated with construction.	Scoped in A simple assessment approach will be adopted involving surveys of breeding and wintering birds. Maps will be produced and annotated in terms of commitments to standard (secondary) mitigation (e.g. Having an ECoW on site to check vegetation for breeding birds prior to its removal).	Standard breeding bird and wintering bird survey techniques in accordance with Natural England requirements covering areas of representative habitat affected by the onshore Hornsea Four project components.
Impacts on otter and / or water vole: **Construction phase** Open cut trenching and HDD used to cross watercourses with otter and / or water vole potential could lead to loss of habitat, disturbance and / or connectivity severance.	*Otter* Range from small to medium Primary Co1 Co34 *Water vole* Tertiary Co123 Range from small to large	High		**Potentially significant without secondary mitigation** Open-cut cable installation methods could temporarily remove, damage or degrade otter and / or water vole habitat. Open-cut trenching and HDD will increase noise, vibration, light and personnel presence associated with construction and could disturb or temporarily displace individual animals.	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of watercourses with otter and / or water vole present. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. setting out the location and extent of any habitat manipulation to temporarily displace individual animals).	Standard otter and water vole survey techniques in accordance with Natural England requirements of the watercourses that will be directly affected by Hornsea Four.
Impacts on great crested newt populations: **Construction phase** Works in or within 250 m of water bodies with great crested newt potential could cause habitat loss, degradation, habitat severance and harm or kill individual animals.	Primary Co2 Co7 Co26 Co78/118	Range from small to large	High	**Potentially significant without secondary mitigation** Great crested newts (GCN) habitat (ponds and terrestrial) could be temporarily lost, damaged or severed/fragmented as a result of construction activities. Individuals could be harmed or killed during construction activities.	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of water bodies with great crested newt present. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. location of new ponds).	Standard GCN survey techniques in accordance with Natural England requirements of the project footprint plus 250 m.
Impacts on white-clawed crayfish and fish: **Construction phase** Open cut trenching, used to cross watercourses could lead to loss of habitat, disturbance and / or connectivity severance on white-clawed crayfish and fish.	Primary Co1 Co34 Tertiary Co123	Range from small to large	Range from low to high	**No likely significant effect**	Scoped out	N/A
Impacts on reptiles: **Construction phase** Construction activities will temporarily occupy areas leading to loss and / or degradation of habitat, loss of habitat connectivity and harm or mortality of individual reptiles.	Primary Co2 Co7 Co26	Small	Low	**Potentially significant without secondary mitigation.** Reptile habitat could be temporarily lost, damaged or severed/fragmented as a result of construction activities. Individuals could be harmed or killed during construction activities.	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of areas with confirmed reptile presence. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. working under a method statement).	Standard reptile survey techniques in accordance with Natural England requirements of representative suitable habitat affected by Hornsea Four.
Impacts on badgers: **Construction phase** Construction activities could disturb badger setts and / or lead to temporary severance of territories.	Primary Co2 Co7 Co26 Co36 Tertiary Co123	Small	Low	**Potentially significant without secondary mitigation.** Construction will increase noise, vibration, light and personnel presence and could disturb badger setts. Badger habitat could be temporarily lost, damaged or territories severed/fragmented as a result of construction activities.	Scoped in A simple assessment approach will be adopted involving survey, identification and mapping of badger setts. The maps will be annotated in terms of commitments to standard (secondary) mitigation (e.g. provision of replacement sett).	Standard badger survey techniques in accordance with Natural England requirements of representative suitable habitat affected by Hornsea Four.
Impacts on habitats or species: **Construction phase** Construction could cause damage to habitats or species from accidental release of pollutants	Tertiary Co114	Negligible	Range from low to high	**No likely significant effect**	Scoped out	N/A
Impacts on habitats or species: **Operation phase** Operation of the onshore substation will cause long-term habitat loss, degradation and potential displacement of protected species		Low	Range from low to high	**Potentially significant without secondary mitigation.** The onshore substation will reduce the area of habitat for the duration of its operation	Scoped in Simple assessment approach will be adopted involving survey, identification and mapping of habitat and areas with confirmed protected species presence.	Phase 1 habitat assessment complete Standard Phase 2 protected species surveys in accordance with Natural England requirements in the onshore substation location plus a 250 m buffer.
Impacts on habitats: **Operation phase** Excavating a section of cable for maintenance or repair could cause temporary habitat loss or degradation		Low	Range from low to high	**No likely significant effect**	Scoped out	N/A

Table A 1.3 Ecology and Nature Conservation Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Impacts on protected species: **Operation phase** Operation and maintenance activities of the onshore cable route could cause disturbance to protected species		Low	Range from low to high	**No likely significant effect**	**Scoped out**	N/A
Impacts on protected species: **Operation phase** Operation and maintenance activities of the onshore substation could cause disturbance to protected species		Low	Range from low to high	**Potentially significant without secondary mitigation** Depending on the onshore substation's final location, increases in noise and light emissions could disturb protected species e.g. bats in ancient woodland.	**Scoped in** Simple assessment approach will be adopted involving survey, identification and mapping of habitat and areas with confirmed protected species presence including mitigation such as the use of minimal directional lighting.	Phase 1 habitat assessment complete Standard Phase 2 protected species surveys in accordance with Natural England requirements in the onshore substation location plus a 250 m buffer.
Impacts on habitats or species: **Operation phase** Operation and maintenance activities could cause damage to habitats or species from accidental release of pollutants		Negligible	Range from low to high	**No likely significant effect**	**Scoped out**	N/A
Impacts on habitats: **Decommissioning phase** Decommissioning of onshore cable could cause temporary loss or degradation to habitat		Not affected	Low to high	**No likely significant effect**	**Scoped out**	N/A
Impacts on habitats: **Decommissioning phase** Decommissioning of the onshore substation could lead to temporary habitat loss or degradation		N/A	Low to high	**Potentially significant without secondary mitigation.** The decommissioning of the onshore substation will likely require land in addition to the substation's operational footprint temporarily in order to decommission the substation which could lead to habitat loss or dearadation.	**Scoped in** Simple assessment approach will be adopted involving survey, identification and mapping of habitat within a 250 m buffer of the onshore substation	Phase 1 habitat assessment complete Standard Phase 2 protected species surveys in accordance with Natural England requirements in the onshore substation location plus a 250 m buffer.
Impacts on protected species: **Decommissioning phase** Decommissioning of the onshore substation could lead to temporary disturbance or displacement of protected species		Low	Low to high	**Potentially significant without secondary mitigation.** The decommissioning of the onshore substation will likely require an additional area to the substation's operational footprint in order to decommission the substation that could lead to temporary habitat loss and disturbance or displacement of protected species.	**Scoped in** Simple assessment approach will be adopted involving survey, identification and mapping of habitat and areas with confirmed protected species presence within a 250 m buffer of the onshore substation	Phase 1 habitat survey complete
Impacts on habitats or species: **Decommissioning phase** Decommissioning of the onshore substation could lead to damage to habitats or species from accidental release of pollutants		Low	Low to high	**No likely significant effect**	**Scoped out**	**N/A**

Table A 1.4 below presents the Landscape and Visual Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.4 Landscape and Visual Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Temporary effects on landscape and viewers of marine works: construction phase Temporary impacts of the construction of offshore elements of Hornsea Four on onshore landscape and visual receptors (e.g. ships and cranes visible from the shore).	Primary Distance of offshore works from land based receptors.	Negligible	Medium	**No likely significant effects**	**Scoped out**	N/A
Permanent effects on landscape and viewers of marine infrastructure: **Operational phase** Permanent impacts of the offshore elements of Hornsea Four on onshore landscape and visual receptors (e.g. booster station and wind turbine generators visible from the shore).	Primary Distance of permanent offshore infrastructure from land based receptors.	Negligible	Medium	**No likely significant effects**	**Scoped out**	N/A
Temporary effects: **Construction phase** Construction activity associated with the landfall, and onshore ECC will temporarily occupy the landfall work area, the ECC working width, compounds and means of access, leading to loss of landscape features and a change to landscape character and to views.	Primary Co2 Co49 Co128	Medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** Temporary loss of landscape features such as hedgerows that will then require replanting.	**Scoped in** A simple assessment approach will be adopted involving survey, identification of features of value to feed into location-specific restoration and reinstatement measures.	Surveys to inform an understanding of landscape features, character and existing views which may be affected.
Permanent/long-term effects resulting from construction activities: **Operational phase** Permanent impact of the landfall and onshore ECR may affect designated and non- designated landscape receptors (including landscape features such as woodlands and hedgerows).	Primary Co25	Negligible	Likely to range from negligible to low	**No likely significant effects** Some landscape features in these areas will be removed during construction. Fences, walls and ditches along field boundaries will be reinstated within one year. Areas of woodland and hedgerow are assumed to be replanted within	**Scoped out**	Surveys to inform an understanding of landscape features, character and existing views which may be affected.
Permanent /long-term effects resulting from construction activities: **Operational phase** Permanent impact of the landfall, and onshore ECC may affect visual receptors in settlements and at individual properties, along key routes (national trails and tourist routes), along other roads and public rights of way, and in accessible and recreational landscapes.	Primary Co25	Negligible	Likely to range from low to high	**No likely significant effects** Some views will be temporarily affected for a period of one year, after which they will be reinstated, other than areas of woodland and hedgerows which are assumed to be replanted within five years.	**Scoped out**	Surveys to inform an understanding of landscape features, character and existing views which may be affected.
Temporary effects on landscape and viewers of the onshore substation site: **construction phase** Construction activity associated with the onshore substation will temporarily occupy the substation construction area, compounds and means of access, leading to loss of landscape features and a change to landscape character and to views. Changes to views may affect visual receptors in settlements and at individual properties, along key routes (national trails and tourist routes), along other roads and public rights of way, and in accessible and recreational landscapes	Primary Co2 Co25 Co26 Co49 Co78 C0128 Tertiary Co7 Co10	Medium	Likely to range from low to high	**Likely significant effects without secondary mitigation** Potentially significant without secondary mitigation such as replanting of sections of hedgerow which may need to be removed.	**Scoped in** A simple assessment approach will be adopted involving survey, identification of features of value to feed into location-specific restoration and reinstatement measures.	Surveys to inform an understanding of landscape features, character and existing views which may be affected during construction.
Permanent effects on landscape and viewers of the onshore substation site: **Operational phase** Operation of the onshore substation will permanently occupy land which is currently characterised by agricultural use, with hedgerows and woodlands beyond, leading to loss of landscape features, and a change to landscape character and to views.	Primary Co2	Medium to large	Likely to range from low to high	**Likely significant effects without secondary mitigation** Potentially significant without secondary mitigation such as planting new hedgerows and woodland to help screen the new infrastructure from views and to integrate it into the landscape.	**Scoped in** A detailed assessment will be adopted involving survey, identification of features of value and to feed into location-specific mitigation including earth modelling and woodland and hedgerow planting. A selection of photomontages will be provided.	Surveys to inform an understanding of landscape features, character and existing views which may be affected during construction.
Temporary effects on landscape and viewers: **Decommissioning phase** Decommissioning of all works could affect the landscape and views	Tertiary Co127	Medium to large scale, but short duration	Likely to range from low to high	**No likely significant effects**	**Scoped out**	N/A

Table A 1.5 below presents the Historic Environment Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.5 Historic Environment Impacts and Effects Register

Project Activity and Potential Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Direct impacts on designated heritage assets: **Construction phase** Construction activities which may lead to the disturbance of or removal of assets.	Avoidance of designated heritage assets through design	None	Medium to High	**No likely significant effect**	**Scoped out**	None
Indirect impacts on designated heritage assets: **Construction Phase** Construction activities which may lead a change in the setting of assets.	n/a	No change to large	Medium to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A detailed assessment will be undertaken, including desk studyandwalkover survey to make setting assessment.	Results of walkover survey
Direct impacts on non-designated heritage assets: **Construction phase** Construction activities which may lead to disturbance of or removal of assets.	n/a	No change to large	Low to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A detailed assessment will be undertaken, including desk study, walkover survey and geophysical survey.	Results of walkover survey and geophysical survey and targeted trial trenching, where appropriate, are required
Indirect impacts on non-designated heritage assets **Construction Phase** Construction activities which may lead a change in the setting of assets.	n/a	No change to large	Low to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Indirect impacts on designated heritage assets **Operation phase** As a result of the presence of infrastructure in the landscape with the potential to result in a change in setting of assets.	n/a	No change to large	Medium to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment), consultation and collaboration with the landscape and visual impact assessment.	None
Indirect impacts on non-designated heritage assets **Operation phase** As a result of the presence of infrastructure in the landscape with the potential to result in a change in setting of assets.	n/a	No change to large	Low to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Direct impacts on designated heritage assets: **Decommissioning phase** Decommissioning activities which may lead to the disturbance of or removal of assets.	Avoidance of designated heritage assets through design	None	Medium to High	**No likely significant effect**	**Scoped out**	None
Direct impacts on non-designated heritage assets **Decommissioning phase** Decommissioning activities which may lead to the disturbance of or removal of assets.	n/a	No change to large	Low to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Indirect impacts on designated heritage assets **Decommissioning phase** Decommissioning activities which may lead a change in the setting of assets.	n/a	No change to large	Medium to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	None
Indirect impacts on non-designated heritage assets **Decommissioning:** Decommissioing activities which may lead a change in the setting of assets.	n/a	No change to large	Low to High	**Likely significant effect without secondary mitigation**	**Scoped in.** A simple assessment will be undertaken, including desk study and walkover survey (including setting assessment)	Potential requirement for further geophysical survey depending on footprint of decommissioning works

Table A 1.6 below presents the Land Use and Agriculture Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.6 Land Use and Agriculture Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment	Further Baseline Data Requirements
Temporary disruption / reduction in land: **Construction phase** Impacts of construction on agricultural land and farm holdings resulting in temporary disruption or reduction in land available for farming activities.	Tertiary: Co10	Medium	High	**Likely significant effects without secondary mitigation.** The scoping boundary includes agricultural land and areas considered "Best and most versatile" agricultural land (ALC Grades 1, 2 and 3a) may be affected.	**Scoped in** Detailed assessment will include a desktop study of agricultural land affected by Hornsea Four.	N/A
Temporary disruption: **Construction phase:** Impacts of construction may affect recreational use of the coast through temporary disruption to beach access and coastal paths.	Primary: Co79	Small	Low	**No likely significant effects** Local recreational resources will only be affected for the duration of the construction works.	Scoped out	N/A
Impacts on recreation and amenity: **Construction phase** Impacts of construction may affect recreational resources and amenity (noise, dust, and traffic movements)	Tertiary: Co124	Medium	Medium	**Likely significant effects without secondary mitigation.** Local recreational resources and visitor attractions will only be affected for the duration of the works.	Scoped in Simple assessment will include a desktop review of recreational resources which are likely to be affected.	N/A
Severance, temporary diversion or closure: **Construction phase** Impacts of construction may affect National Cycle network Routes, other PRoW and promoted routes, resulting in severance, temporary diversion or closure.	Primary: Co79	Medium	High	**Likely significant effects without secondary mitigation.** There are National Cycle Network routes, other PRoWs and promoted routes within the onshore scoping boundary.	**Scoped in** Detailed assessment will include a desktop review of PRoWs, National Cycle Network routes and other recreational routes and a targeted walkover survey to establish their nature and condition.	Targeted site walkovers will be required.
Permanent disruption / reduction of land: **Operation and maintenance phase** Impacts of operation and maintenance of the cable route corridor and onshore substation may affect Agricultural Land and farm holdings, resulting in permanent disruption or reduction in land available for farming activities.	Tertiary: Co10	Negligible	High	**No likely significant effects** The onshore ECC search areas are on agricultural land and areas considered "Best and most versatile" agricultural land (ALC Grades 1, 2 and 3a) may be affected. They may also be affected temporarily if sections of cable need to be uncovered for repair/investigation although impacts would be minimal and likely short lived.	Scoped out	N/A
Temporary disruption / reduction in land: **Decommissioning phase** Impacts of decommissioning above ground installations may temporarily affect Agricultural Land and farm holdings, resulting in temporary disruption or reduction in land available for farming activities.	Tertiary: Co127	Negligible	High	**No likely significant effects** The onshore ECC and substation search areas are on agricultural land and areas considered "Best and most versatile" agricultural land (ALC Grades 1, 2 and 3a). Impacts are expected to be minimal however as above ground installations are small and cabling will remain in-situ.	Scoped out	N/A

Table A 1.7 below presents the Traffic and Transport Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.7 Traffic and Transport Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance / Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage	Proposed Approach to Assessment	Further Baseline Data Requirements
Impact from transport of offshore project components on the road network: Construction Phase Pre-fabricated off-shore construction elements (wind turbines/foundations etc.) could affect traffic if transported by road	All offshore project components are assumed to be fabricated off-site, stored at a suitable port facility and transported directly offshore as needed.	Negligible	Low	**No likely significant effects**	**Scoped out**	N/A
Impact on Driver Delay on regionally, nationally or internationally significant roads: Construction Phase Additional construction traffic may influence driver delay.	Primary Co1	Small	High	**Likely significant effect without secondary mitigation** Effects on the SRN due to construction traffic	**Scoped in.** A detailed, fully quantitative assessment will be undertaken using project collected data and surveys to determine the level of effect.	Traffic flow data for in-scope roads and junctions
Impact on Driver Delay on locally significant roads: Construction Phase Additional construction traffic may influence driver delay.	Primary Co1	Medium	Medium	**Likely significant effect without secondary mitigation** Construction traffic movements on the A164 and other key roads in the County	**Scoped in.** A detailed, fully quantitative assessment will be undertaken using project collected data and surveys to determine the level of effect.	Traffic flow data for in-scope roads and junctions
Impact on Driver Delay on local roads and past locally sensitive receptors: Construction Phase Additional construction traffic may influence driver delay and affect sensitive receptors	Primary Co1	Large	Low	**Likely significant effect without secondary mitigation** Construction traffic movements on the A164 and other key roads in the County	**Scoped in.** A simple qualitative assessment will be undertaken using network observations and other existing baseline information.	Traffic flow data for in-scope roads and junctions
Impact on Driver Delay on very minor local roads, parts of roads or uni-directional impact: Construction Phase Additional construction traffic may influence driver delay	Primary Co1	Large	Negligible	**No likely significant effect**	**Scoped out**	N/A
Severance: Construction Phase The temporary impact of the construction work may affect severance of routes/cause severance.	Primary Co2	Small	Low	**No likely significant effect**	**Scoped Out**	
Pedestrian delay and amenity: Construction Phase The temporary impact of the construction work may affect pedestrian delay and amenity	Tertiary Co79 Primary Co80	Small	Medium	**Likely significant effect without secondary mitigation.** Impact will reduce amenity of users and may increase delay slightly. PRoWs typically not used by large numbers but are well protected by legislation/acts of parliament	**Scoped in.** A simple assessment will be undertaken. This is likely to be the identification of all in-scope footways and PRoWs that are crossed or affected by the construction works and the identification of safe methods of working in a CoCP.	PRoW (definitive) map
Accidents and Road Safety: Construction Phase The temporary impact of the construction work may affect accidents and road safety.	Tertiary Co124	Large	High	**Likely significant effect without secondary mitigation.** Serious injury or death could result. Particularly at access points where vehicle conflicts occur and risk levels are high. The sensitivity increases if vulnerable road users are present	**Scoped in.** A detailed assessment will be undertaken including collision analysis of all parts of the road network significantly affected by the construction works and traffic engineering input to ensure that permanent and temporary construction access points meet modern design standards and provide evidence that these can be trafficked safely.	Accident data for temporary and permanent access point locations. Topographic data or mapping tiles to design a safe road layout
Hazardous and Abnormal Loads: Construction Phase The temporary impact of hazardous, dangerous and abnormal loads during construction works.		Large	High	**Likely significant effect without secondary mitigation.** Transformers likely to be massively abnormal in every dimension. Potential damage to highway structures. Risk to other road users during the move. Specialist vehicles required. Route also uses SRN adjacent to the Port and Humber Bridge – nationally important piece of the network	**Scoped in.** A detailed assessment will be undertaken including a full review of the abnormal load route from the SRN for critical structure dimensions/capability. Swept path analysis of key junctions, bends and other constraints on the route.	Bogie bolster/vehicle dimensions/details Mapping tiles for swept path analysis Highway structure data Chosen transformer details
Impacts from traffic generation: Operation Potential traffic impacts arising from the operation and maintenance of the onshore elements	N/A	Negligible	Low	**No Likely significant effect**	**Scoped out**	
Impacts from traffic generation: Decommissioning The temporary impact of the decommissioning work may affect driver delay, safety and other elements of the network	Tertiary Co127	Varied	Varied	**No likely significant effect**	**Scoped out**	
Impact of Hornsea Four on Planned Changes in the Network: Construction Phase	N/A	Small	Low	**Likely significant effect without secondary mitigation.** Large construction project nearby on A164 and surrounds with similar timeframe. Impact on construction traffic; routing; TM etc. Could be construction benefits/savings from joined up working.	**Scoped in.** A simple qualitative assessment will be undertaken of the various schemes and identification of overlaps and potential points of interface.	Establish an interface to the ERYC A164 improvement team and A63 Castle Street, Hull (c/o Highways England)

Table A 1.8 below presents the Noise and Vibration Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.8 Noise and Vibration Impacts and Effects Register

Project Activity and Potential Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect at Scoping Stage	Proposed Approach to Assessment	Further Baseline Data Requirements
Indicative temporary works area - temporary noise and vibration from onshore cable installation (excluding HDD works): Construction Phase	Primary Co36 Co41 Co133	Small	High	No likely significant effect	Scoped out	N/A
Indicative temporary works area - temporary noise and vibration from HDD works and other trenchless technologies: Construction Phase	Primary Co36 Co41 Co134	Small - Large	High	Likely significant effect without secondary mitigation HDD will only be required in certain circumstances (e.g. road, rail or river crossings). Depending on the size of equipment required for each crossing, NSRs may experience significant effects, however these will normally be relatively brief. Should HDD be required at night, impacts may be greater.	Scoped in. A detailed assessment will be undertaken using data inputs and / or a calculation method	In some cases, baseline noise monitoring may be required to better understand the significance of potential noise effects.
Landfall, nearshore and intertidal area - temporary noise and vibration from cable installation works: Construction Phase	Co134	Small - Large	High	Likely significant effect without secondary mitigation Subject to the proximity of receptors to the works.	Scoped in. Detailed assessment using data inputs and / or a calculation method	Baseline noise monitoring may be required to better understand the
Temporary noise and vibration from constructing the jointing bays : Construction Phase	Primary Co36	Small - Large	High	Likely significant effect without secondary mitigation. Noise effects dependent on proximity to NSRs.	Scoped in. A simple assessment e.g. a spreadsheet calculation will be undertaken.	N/A
Temporary noise and vibration from constructing the haul road access points: Construction Phase	Primary Co36 Co41 Co135	Small	High	Likely significant effect without secondary mitigation Construction access roads will be located at least 150 m from noise sensitive properties. At this distance noise levels are predicted to be below the construction criteria.	Scoped out	N/A
Temporary noise and vibration from construction of the onshore substation: Construction Phase Includes the temporary impacts of tubular steel piling (percussive piling)	Primary Co36	Small - Large	High	Likely significant effect without secondary mitigation. Subject to the proximity of receptors to the selected substation site and/or without secondary mitigation in place	Scoped in. A detailed assessment will be undertaken using data inputs and / or a calculation method if percussive piling is proposed.	N/A
Traffic noise: Construction Phase	Primary Co36	Small - Large	High	Likely significant effect without secondary mitigation. Subject to the anticipated volumes of traffic and/or without secondary mitigation in place	Scoped in. A simple assessment e.g. a spreadsheet calculation will be undertaken.	Existing traffic flow data for the construction traffic route.
Noise from the onshore substation: Operation	N/A	Small - Large	High	Likely significant effect without secondary mitigation. Noise effects dependent on design, layout and proximity to NSRs.	Scoped in. A detailed assessment using data inputs and / or a calculation method will be undertaken.	Where the potential for significant noise effects is identified background noise monitoring will be undertaken at residential properties close to the onshore substation.
Noise from buried cable: Operation	N/A	No Change	High	No likely significant effect.	Scoped out	N/A
Operational Traffic Noise: Operation	Tertiary Co137	Negligible	High	No likely significant effect.	Scoped out	N/A
Noise and vibration from routine maintenance activities: Operation	N/A	Negligible	High	No likely significant effect.	Scoped out	N/A
Vibration: Operation	N/A	Negligible	High	No likely significant effect.	Scoped out	N/A
Noise from operation of the offshore HVAC booster: Operation	The offshore HVAC booster will be located at least 20 km from shore.	Negligible	High	No likely significant effect.	Scoped out	N/A
Temporary noise and vibration from plant along the cable route: Decommissioning	Primary Co36	Negligible	High	No likely significant effect.	Scoped out	N/A
Temporary noise and vibration from plant at the onshore substation: Decommissioning	Primary Co36	Small - Large	High	Likely significant effect without secondary mitigation. Impacts are likely to be no higher than for construction.	Scoped in. A simple assessment e.g. a spreadsheet calculation will be undertaken.	N/A

Table A 1.9 below presents the Air Quality Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result oflegislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 1.9 Air Quality Impacts and Effects Register

Project Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect (LSE) at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed	Further Baseline Data Requirements
Dust generation: **Construction phase** Dust raising activities (earthworks, traffic on unpaved areas, construction works) from onshore construction works. This may have an effect on human and ecological receptors sensitive to dust and PM_{10}.	Primary Co41 Tertiary: Co64 Co114 Co124	Negligible	Medium	**No likely significant effects**	**Scoped out**	None
Dust generation and exhaust emissions from traffic **All phases** Construction, operational (maintenance of onshore export cable) and decommissioning related traffic will be associated with emissions of dust and exhaust gases, which may affect human and ecological receptors.	None required.	Negligible	Medium	**No likely significant effects**	**Scoped Out**	None
Emissions from facilities: **Operational phase** Operation and maintenance of the onshore export cable and onshore substation may affect human and ecological receptors.	None required.	No change	Negligible	**No likely significant effects**	**Scoped out**	None
Dust generation: **Decommissioning phase** Temporary impacts of decommissioning of the OnSS may affect receptors sensitive to dust (human and ecological).	Primary: Co41 Tertiary: Co64 Co114 Co124	Negligible	Low	**No likely significant effects**	**Scoped out**	None

Table A 2.1 below presents the Physical Processes Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.1 Physical Processes Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	Seabed levelling for GBF placement or sandwave clearance (for cable laying, etc) leading to removal of seabed material and requirements for spoil disposal	None	Negligible, short-term and spatially restricted	Location specific	**Likely significant effect without secondary mitigation** TBC: Project description details to be developed	Scoped In Simple assessment based on sites involved, with spoil volumes, particle size, water depths and current speeds. Assessment qualified against previous sediment plume modelling for Hornsea Project One, Hornsea Project Two and Hornsea Three.	None
Construction	All direct sediment disturbance activities that may lead to increased suspended sediments (e.g. drilling, cable laying, seabed levelling, etc.)	Primary Co44, Co45	Negligible, short-term and spatially restricted	Location specific	**Likely significant effect without secondary mitigation** Project description details to be developed for excavation quantities and construction rates. Sediment material is likely to fall out of suspension relatively quickly.	Scoped In Simple assessment based on spoil volumes, particle size, water depths and current speeds. Assessment qualified against previous sediment plume modelling for Hornsea Project One, Hornsea Project Two and Hornsea Three.	None
Operation	Scouring around foundations	Primary Co82	Negligible, short-term and spatially restricted	Low	**No likely signficant effect**	Scoped Out	None
Operation	Turbid wake effects from foundations interfering with Flamborough Front	None	Minor	Medium	**Likely significant effect without secondary mitigation** Flamborough Front is relatively close but also limited in position by deeper water to the north. The scale of any wake reaching the front needs to consider further details of the project description such as array layout and foundation spacing.	Scoped In Simple assessment based on magnitude and extents of wakes relative in proximity to the front and a consideration of the normal seasonal effects which restrict the front to summer periods.	None
Decomissioning	Changes to waves affecting coastal morphology	None	Negligible	Medium	**Likely significant effect without secondary mitigation** Ddistance from Hornsea Four array area is expected to be sufficient so that any wave attenuation is fully dissipated before reaching the coastline	Scoped In Simple assessment based on determining relative scales of wave related blockage and compared to adjacent projects and qualified using previous wave modelling for Hornsea Project One, Hornsea Project Two and Hornsea Three.	None
Decomissioning	Changes to sediment pathways	None	Negligible	Medium	**No likely signficant effect**	Scoped Out	None

Table A 2.2 below presents the Benthic and Intertidal Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.2 Benthic and Intertidal Ecology Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	Temporary habitat disturbance in the Hornsea Four array area and offshore ECC from construction activities.	Primary Co44, Co45, Co84, Co86	Minor	Low or medium	No likely significant effect.	Scoped Out	None
Construction	Temporary habitat disturbance in the intertidal area from export cable installation.	Primary Co44, Co45, Co84, Co86	Minor	Not sensitive	No likely significant effect.	Scoped Out	None
Construction	Temporary increase in SSC and sediment deposition in the Hornsea Four array area and offshore ECC.	None	Minor	Low or medium	No likely significant effect.	Scoped Out	None
Construction	Temporary increase in SSC and sediment deposition in the intertidal area.	None	Minor	Not sensitive	No likely significant effect.	Scoped Out	None
Construction	Impacts on benthic ecology from noise arising from foundation installation.	Tertiary Co109	Minor	Not sensitive or Low	No likely significant effect.	Scoped Out	None
Construction	Direct and indirect seabed disturbances leading to the release of sediment contaminants.	None	Negligible to low	Negligible	No likely significant effect.	Scoped Out	None
Construction	Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	Tertiary Co111	Negligible	Negligible	No likely significant effect.	Scoped Out	None
Operation	Long-term habitat loss/ change from the presence of foundations, scour protection and cable protection.	Primary Co44, Co45, Co83, Co84, Co86	Negligible	Low (to potentially High)	No likely significant effect.	Scoped Out	None
Operation	Colonisation of the WTGs and scour/ cable protection may affect benthic ecology and biodiversity.	None	Negligible	Low	No likely significant effect.	Scoped Out	None
Operation	Increased risk of introduction or spread of Marine Invasice Non-Native Species (MINNS) due to presence of subsea infrastructure and vessel movements (e.g. ballast water) may affect benthic ecology and biodiversity.	Tertiary Co111	Negligible	Medium	No likely significant effect.	Scoped Out	None
Operation	Direct disturbance to seabed from jack-up vessels and cable maintenance activities.	Primary Co44, Co45, Co83, Co84, Co86	Negligible	Low to medium	No likely significant effect.	Scoped Out	None
Operation	Indirect disturbance to benthic species from EMF generated by inter-array and export cables.	Primary Co83	Negligible	Negligible	No likely significant effect.	Scoped Out	None
Operation	Changes to seabed habitats arising from effects on physical processes, including scour effects and changes in the sediment transport and wave regimes resulting in potential effects on benthic communities.	None	Minor	Low	No likely significant effect.	Scoped Out	None
Operation	Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	Tertiary Co111	Negligible	Negligible	No likely significant effect.	Scoped Out	None
Decomissioning	Temporary habitat disturbance from decommissioning of foundation substructures and cables.	None	Minor	Low or medium	No likely significant effect.	Scoped Out	None
Decomissioning	Increased SSC and sediment deposition from removal of foundations and cables.	None	Minor	Low to medium	No likely significant effect.	Scoped Out	None
Decomissioning	Loss of introduced habitat from the removal of foundations.	None	Low	Low	No likely significant effect.	Scoped Out	None
Decomissioning	Accidental release of pollutants (e.g. from accidental spillage/leakage) may affect benthic ecology.	Tertiary Co111	Negligible	Negligible	No likely significant effect.	Scoped Out	None

Table A 2.3 below presents the Fish and Shellfish Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.3 Fish and Shellfish Ecology Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from construction activities.	None	Minor	Low to medium	**No likely significant effect**	Scoped Out	None
Construction	Temporary localised increases in SSC and smothering.	None	Minor	Low	**No likely significant effect**	Scoped Out	None
Construction	Direct and indirect seabed disturbances leading to the release of sediment contaminants.	None	Negligible to low.	Low to medium	**No likely significant effect**	Scoped Out	None
Construction	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration.	Tertiary Co109	Minor	Medium	**Likely significant effect without secondary mitigation** On the basis of potential subsea noise arising from piling activity and the presence of sensitive species (such as herring and sandeels within the Hornsea Four study area.	**Scoped In** A detailed assessment approach will be adopted, involving the calculation of the area impacted by subsea noise arising from piling activities within the Hornsea Four array area using noise propagation modelling. Noise impact contours will be determined and the impacts on sensitive fish species assessed against standard thresholds.	The baseline will be informed by the zonal characterisation surveys conducted across the former Hornsea Zone and the infill surveys conducted for Hornsea Project One and Hornsea Project Two supplemented by regional datasets.
Construction	Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors.	Tertiary Co111	Negligible	Low to medium	**No likely significant effect**	Scoped Out	None
Operation	Long-term loss of habitat due to the presence of turbine foundations, scour protection and cable protection.	None	Minor	Low	**No likely significant effect**	Scoped Out	None
Operation	Increased hard substrate and structural complexity as a result of the introduction of turbine foundations, scour protection and cable protection.	None	Minor	Low	**No likely significant effect**	Scoped Out	None
Operation	Underwater noise as a result of operational turbines.	None	Negligible	Low to medium	**No likely significant effect**	Scoped Out	None
Operation	EMF effects arising from cables.	Primary Co83	Minor	Low to medium	**No likely significant effect**	Scoped Out	None
Operation	Direct disturbance resulting from maintenance during operation.	None	Minor	Low to medium	**No likely significant effect**	Scoped Out	None
Operation	Indirect disturbance resulting from the accidental release of pollutants.	Tertiary Co111	Negligible	Low to medium	**No likely significant effect**	Scoped Out	None
Operation	Potentially reduced fishing pressure within the Hornsea Four array area and increases fishing pressure outside the array area due to displacement.	None	Minor	Low	**No likely significant effect**	Scoped Out	None
Decomissioning	Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species arising from decommissioning activities.	None	Minor	Low to medium	**No likely significant effect**	Scoped Out	None
Decomissioning	Temporary localised increases in SSC and smothering.	None	Minor	Low	**No likely significant effect**	Scoped Out	None
Decomissioning	Direct and indirect seabed disturbances leading to the release of sediment contaminants.	None	Negligible to low.	Low to medium	**No likely significant effect**	Scoped Out	None
Decomissioning	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration.	None	Minor	Low to medium	**No likely significant effect**	Scoped Out	None
Decomissioning	Accidental pollution events during the construction phase resulting in potential effects on fish and shellfish receptors.	Tertiary Co111	Negligible	Low to medium	**No likely significant effect**	Scoped Out	None

Table A 2.4 below presents the Marine Mammals Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.4 Marine Mammals Ecology Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	PTS from piling noise	Tertiary Co109, Co110	Minor	Medium	**Likely significant effect without secondary mitigation** Recent expert elicitation for PTS as a result of pile driving resulted in agreement between experts that the predicted PTS effects from exposure to piling noise (defined as 6 dB PTS in the 2-10 kHz band) was unlikely to have a large effect on the survival or reproduction of the species of interest.	**Scoped In** A detailed assessment approach will be adopted involving the calculation of the area impacted by piling noise (by the noise modeller) which will be overlain on species specific density surfaces to estimate the number of animals impacted.	None
Construction	Disturbance from piling noise	Tertiary Co109, Co110	Minor	Medium	**Likely significant effect without secondary mitigation** Evidence from telemetry and acoustic detection data at previous offshore wind farms show animals are displaced during piling but return after piling ceases.	**Scoped In** A detailed assessment approach will be adopted involving the calculation of the area impacted by piling noise (by the noise modeller) which will be overlain on species specific density surfaces and combined with a dose-response curve to estimate the number of animals impacted.	None
Construction	TTS from piling noise	Tertiary Co109, Co110	Cannot be assessed	Cannot be assessed	**No likely significant effect**	Scoped Out	None
Construction	Vessel collision risk	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels	**Scoped In** A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during construction activities, existing evidence on marine mammal responses to vessel presence and information on collision related deaths from strandings reports.	Data on baseline vessel activity required
Construction	Offshore Construction: Disturbance from vessels	Tertiary Co108	Minor	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels	**Scoped In** A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during construction activities and existing evidence on marine mammal responses to vessel presence.	Data on baseline vessel activity required
Construction	Offshore Construction: Reduction in prey availability	None	Negligible	Low	**No likely significant effect**	Scoped Out	None
Construction	Offshore Construction: Reduction in foraging ability	None	Negligible	Low	**No likely significant effect**	Scoped Out	None
Construction	Offshore Construction: Toxic contamination	Tertiary Co111	Negligible	Low	**No likely significant effect**	Scoped Out	None
Construction	Offshore Construction: Non-piling noise (e.g. cable laying, dredging)	None	Minor	Low	**Likely significant effect without secondary mitigation** It is unlikely that these activities will impact marine mammal receptors at anything other than the immediate proximity.	**Scoped In** A simple assessment approach will be adopted involving an outline of the duration and likely sound levels from different activities.	None
Construction	Construction of landfall: Disturbance to seal haul-outs	None	Negligible	Negligible	**No likely significant effect**	Scoped Out	None
Construction	Offshore Construction: PTS from UXO clearance	Tertiary Co112	Negligible	Low	**Likely significant effect without secondary mitigation** Magnitude depends on charge size which is currently unknown. Hornsea Three predicted Negligible-Low magnitude impacts of PTS for charge sizes up to 260 kg.	**Scoped In** A simple assessment approach will be adopted involving either the modelling of different charge sizes or using data from different charge sizes from the literature.	None
Construction	Offshore Construction: Disturbance from UXO clearance	Tertiary Co112	Negligible	Low	**Likely significant effect without secondary mitigation** Magnitude depends on charge size which is currently unknown. Hornsea Three predicted Negligible-Low magnitude impacts of disturbance out to a 26 km radius due to the short-lived disturbance and low proportion of population predicted to be impacted.	**Scoped In** A simple assessment approach will be adopted. In the absence of empirical data on the likelihood of response to explosives the assessment will involve the application of a 26 km buffer around a UXO source location to determine the number of animals predicted to be disturbed. This is based on Natural England and JNCC advice that a buffer of 26 km around the source location is used to determine the impact area from UXO clearance with respect to disturbance of harbour porpoise in the Southern North Sea cSAC.	None
Construction	Offshore Construction: TTS from UXO clearance	Tertiary Co112	Cannot be assessed	Cannot be assessed	**No likely significant effect**	Scoped Out	None
Operation	Operation: Operational noise	None	Negligible	Negligible	**No likely significant effect**	Scoped Out	None
Operation	Vessel collision risk	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels.	**Scoped In** A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during operation, existing evidence on marine mammal responses to vessel presence and information on collision related deaths from stranding reports.	As for construction – baseline information on vessel use
Operation	Disturbance from vessels	Tertiary Co108	Negligible	Low	**Likely significant effect without secondary mitigation** It is not expected that there will be a significant increase in vessel activity over the baseline levels.	**Scoped In** A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during operation and existing evidence on marine mammal responses to vessel presence.	As for construction – baseline information on vessel use
Operation	Reduction in prey availability	None	Negligible	Negligible	**No likely significant effect**	Scoped Out	None
Operation	Reduction in foraging ability	None	Negligible	Negligible	**No likely significant effect**	Scoped Out	None
Operation	Toxic contamination	Tertiary Co111	Negligible	Low	**No likely significant effect**	Scoped Out	None

Table A 2.4 Marine Mammals Ecology Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operation	EMF	None	No change	Negligible	No likely significant effect	Scoped Out	None
Decomissioning	PTS from underwater noise	Tertiary Co113	Negligible	Low	Likely significant effect without secondary mitigation Depends on the method used to remove structures. Methods such as hot cutting (Brocotorch), diamond wire cutting and abrasive water jet cutting are all expected to have negligible impact due to low noise levels and the temporary nature of the impact.	Scoped In A simple assessment approach will be adopted involving the presentation of expected underwater noise levels produced by various cutting techniques (where available) and an assessment as to whether or not this is likely to impact marine mammals.	None
Decomissioning	Disturbance from underwater noise	Tertiary Co113	Negligible	Medium	Likely significant effect without secondary mitigation Depends on the method used to remove structures. Methods such as hot cutting (Brocotorch), diamond wire cutting and abrasive water jet cutting are all expected to have negligible impact due to low noise levels and the temporary nature of the impact.	Scoped In A simple assessment approach will be adopted involving the presentation of expected underwater noise levels produced by various cutting techniques (where available), the expected duration of activities and an assessment as to whether or not this is likely to impact marine mammals.	None
Decomissioning	TTS from underwater noise	Tertiary Co113	Cannot be assessed	Cannot be assessed	No likely significant effect	Scoped Out	None
Decomissioning	Vessel collision risk	Tertiary Co108	Negligible	Low	Likely significant effect without secondary mitigation It is not expected that there will be a significant increase in vessel activity over the baseline levels.	Scoped In A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during decommissioning activities, existing evidence on marine mammal responses to vessel presence and information on collision related deaths from stranding reports.	As for construction – baseline information on vessel use
Decomissioning	Disturbance from vessels	Tertiary Co108	Negligible	Low	Likely significant effect without secondary mitigation It is not expected that there will be a significant increase in vessel activity over the baseline levels.	Scoped In A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during decommissioning activities and existing evidence on marine mammal responses to vessel presence.	As for construction – baseline information on vessel use
Decomissioning	Reduction in prey availability	None	Negligible	Negligible	No likely significant effect	Scoped Out	None
Decomissioning	Reduction in foraging ability	None	Negligible	Negligible	No likely significant effect	Scoped Out	None
Decomissioning	Toxic contamination	Tertiary Co111	Negligible	Low	No likely significant effect	Scoped Out	None

Table A 2.5 below presents the Offshore and Intertidal Ornithology Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.5 Marine Mammals Ecology Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	Construction activities within the array area associated with foundations and WTGs may lead to disturbance and displacement of species within the array and different degrees of buffers surrounding it.	Tertiary Co86, Co88	Negligible to Low	Negligible to High	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor depending on species assessed. This is due to any potential impacts being minimised spatially to a small number of foundations and / or WTGs at any one time and temporally due to the construction phase being limited in time.	**Scoped In** Simple Assessment based on the WCS considered for the most sensitive species, most likely to be guillemot and razorbill.	Offshore Ornithology baseline data on seabirds within array and specific buffer surrounding it (this data is already available). Data on construction timetable and the period over which it will be undertaken.
Construction	Indirect impacts during the construction phase within the array area through effects on habitats and prey species.	None	Negligible	Negligible to low	**No likely significant effect**	**Scoped Out**	Dependent upon baseline of other chapters such as benthic / fish.
Construction	Construction activities associated with export cable laying may lead to disturbance and displacement of species within the export cable corridor and different degrees of buffers surrounding it.	Primary Co88	Negligible to low	Negligible to Medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor depending on species assessed. This is due to any potential impacts being minimised spatially to a single cable laying vessel and temporally due to the construction phase being limited in time. Also, the most sensitive species (divers) are not found in high densities within study area.	**Scoped In** Simple Assessment based on the WCS, which in this instance is considered for most the sensitive species such as auks and divers.	Offshore Ornithology baseline data on seabirds within the study area (including the array, a 4 km buffer and the export cable corridor). Data on the construction timetable and the period over which it will be undertaken.
Construction	Construction activities associated with trenching, laying and reburial of the export cable through the intertidal zone may lead to disturbance and displacement of waterbird species in close proximity to the works.	None	Negligible	Negligible	**Likely significant effect without secondary mitigation** LSE is not significant, as very few waterbirds reside within the intertidal area and most species are tolerant of disturbance activities that are limited spatially and temporally.	**Scoped In** Simple Assessment based on similar projects within region and case study examples.	Desk based review to ascertain species of interest. Unlikely that any new surveys would be required, due to previous OWF project data and other recent data sources covering this stretch of coastline.
Operation	Operational activities associated with moving turbines and maintenance vessels may lead to disturbance and displacement of species within the array area and different degrees of buffers surrounding it.	None	Negligible to Medium	Negligible to Medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor/moderate depending on species assessed.	**Scoped In** Detailed assessment required to assess species of interest and their distribution (within the Array area, a suitable buffer) and the relevant biological period of interest.	Offshore Ornithology baseline data required on seabirds within array and specific buffer surrounding it (this data is already available). Information on the maintenance schedule.
Operation	Seabirds flying through the array area during the operational phase are at risk of collision with WTG rotors and associated infrastructure. The result of such collisions may be fatal to the bird concerned.	Primary Co101, Co138	Negligible to medium	Negligible to high	**Likely significant effect without secondary mitigation** LSE likely to be between not significant and moderate / major, as initial consideration of collision risk highlighted as key consideration for the Hornsea Four project. Risk resulting from in-combination effects with other OWFs is greatest.	**Scoped In** Detailed Assessment as Hornsea Four is the closest of all Hornsea OWF projects to the FFC pSPA seabird colony	Offshore Ornithology baseline data required on flying seabirds within array (this data is already available). Information on the number of WTGs and preparation of the Worst Case Scenario for CRM.
Operation	Migrant non-seabirds flying through the array area during the operational phase are at risk of collision with WTG rotors and associated infrastructure. The result of such collisions may be fatal to the bird concerned.	None	Negligible	Negligible to medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant or minor as previous impact assessments conducted for OWFs in the North Sea have concluded negligible or minor. There are no reasons why this project would be deemed any different.	**Scoped In** Simple Assessment based on similar projects within region and case study examples.	Previous Hornsea projects can provide initial data for consideration in this assessment.
Operation	Indirect impacts within the array area during the operational phase through effects on habitats and prey species.	None	Negligible	Negligible to low	**No likely significant effect**	**Scoped Out**	Dependent upon baseline of other chapters such as benthic / fish.
Operation	The presence of WTGs could create a barrier to the migratory or regular foraging movements of seabirds. This may result in permanent changes in flying routes for birds concerned and an increase in energy demands associated with those movements may result in a lower rate of breeding success or survival chances for individuals affected.	None	Negligible to low	Negligible to medium	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor. This impact is not widely assessed as being significant and displacement impacts are considered to be the more important focus.	**Scoped In** Simple assessment Hornsea Four is the closest of the Hornsea projects to the seabird breeding colonies of the FFC pSPA and as such presents a risk of creating a barrier to adult birds seeking to forage during the chick rearing stage in sea areas beyond the development boundary.	Offshore Ornithology baseline data required on seabirds within array and specific buffer surrounding it (these data are already available). Tracking study data and recent peer reviewed papers and OWF EIAs on this topic.
Operation	Potential for ad-hoc maintenance of export cable throughout operational phase, which may lead to disturbance and displacement of species within the export cable corridor and different degrees of buffers surrounding it.	None	Negligible	Negligible to low	**No likely significant effect**	**Scoped Out**	Desk based review to ascertain species of interest characterised in baseline report.
Operation	Potential for ad-hoc maintenance of export cable through the intertidal zone during the operational phase may lead to disturbance and displacement of waterbird species in close proximity to the works.	Tertiary Co86, Co88	Negligible	Negligible	**No likely significant effect**	**Scoped Out**	Desk based review to ascertain species of interest characterised in baseline report.
Decomissioning	Demolition activities associated with foundations and WTGs may lead to disturbance and displacement of species within the array area and different degrees of buffers surrounding it.	Tertiary Co86, Co88	Negligible to low	Negligible to low	**Likely significant effect without secondary mitigation** LSE likely to be not significant to minor as species are less sensitive to lower scale activities associated with decommissioning.	**Scoped In** Simple Assessment required to assess species of interest and their distribution (within the Array area).	This is reliant upon the agreed potential LSE of construction & operational displacement assessments.
Decomissioning	Indirect impacts during the decommissioning phase within the offshore export cable corridor and landfall through effects on habitats and prey species.	None	Negligible	Negligible	**Likely significant effect without secondary mitigation** No LSE considered likely, though this would depend on outcome of other chapter assessments on benthic / fish, but no OWF EIA submitted to date has predicted a significant impact from this source on birds.	**Scoped Out**	Dependent upon baseline of other chapters on benthic / fish.

Table A 2.6 below presents the Marine Archaeology Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.6 Marine Archaeology Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	Removal of sediment containing undisturbed archaeological contexts leading to total loss of the receptor during preparation of the seabed for WTG and offshore substation foundations.	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Very High	**No likely significant effect**	Scoped Out	Review of the site-specific geophysical survey data providing 100% coverage of Hornsea Four; archaeological assessment of geotechnical data.
Construction	Intrusion of piling foundations disturbing or destroying archaeological receptors.	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Very High	**No likely significant effect**	Scoped Out	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Construction	Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and wind turbine.	Primary Co46 Secondary Co140) Tertiary Co141, Co142)	Negligible	Very High	**No likely significant effect**	Scoped Out	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Construction	Disturbance of sediment containing potential archaeological receptors (material and contexts) during inter-array cable laying operations.	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Very High	**No likely significant effect**	Scoped Out	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data
Construction	Disturbance of sediment containing potential archaeological receptors (material and contexts) during export cable laying operations.	Primary Co46 Secondary Co140) Tertiary Co141, Co142	Negligible	Very High	**No likely significant effect**	Scoped Out	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Construction	Penetration and compression effects of jack-up barges and anchoring of construction vessels during turbine, sub-station or cable installation leading to total or partial loss of archaeological receptors (material or contexts).	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Very High.	**No likely significant effect**	Scoped Out	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Operation	Scour effects caused by (a) the presence of WTG substation foundations, and (b) the exposure of inter-array and export cables or the use of cable protection measures, impacting archaeological receptors and exposing such material to natural, chemical or biological processes and causing or accelerating loss of the same.	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Moderate	Very High	**Likely significant effect without secondary mitigation** Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position and extent of the marine archaeological resources at Hornsea Four not yet established.	Scoped In A simple assessment approach will be adopted involving review of geophysical survey data, identification of features of value to feed into location-specific AEZ development for avoidance.	Review of geophysical survey data providing colcted for the purposes of monitoring during operation with 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data; Marine Processes input to determine extent of scour effects.
Operation	Penetration and compression effects on seabed caused by corrective and preventative operation and maintenance activities (via jack-up vessels) leading to total or partial loss of archaeological receptors (material or contexts).	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Moderate	Very High	**Likely significant effect without secondary mitigation** Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position and extent of the marine archaeological resources at Hornsea Four not yet established.	Scoped In A simple assessment approach will be adopted involving review of geophysical survey data, identification of features of value to feed into location-specific AEZ development for avoidance.	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.
Decomissioning	Draw-down of sediment into voids left by removed turbine foundations leading to loss of sediment, destabilising archaeological sites and contexts, and exposing such material to natural, chemical or biological processes, and causing or accelerating loss of the same.	Primary Co46 Secondary Co140) Tertiary Co141, Co142	Moderate	Very High	**Likely significant effect without secondary mitigation** Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position and extent of the marine archaeological resources at Hornsea Four not yet established.	Scoped In A simple assessment approach will be adopted involving review of geophysical survey data, identification of features of value to feed into location-specific AEZ development for avoidance.	Review of geophysical survey data providing colcted for the purposes of monitoring during operation with 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data; Marine Processes input to determine extent of scour effects.
Decomissioning	Penetration and compression effects of jack-up barges and anchoring of decommissioning vessels leading to total or partial loss of archaeological receptors (material or contexts).	Primary Co46 Secondary Co140 Tertiary Co141, Co142	Negligible	Potentially significant without secondary mitigation. Currently only the broad locations of known wrecks and obstructions are available, with the position and extent of the marine archaeological resources at Hornsea Four not yet established.	**No likely significant effect**	Scoped Out	Review of site-specific geophysical survey data providing 100% coverage of final Hornsea Four; archaeological assessment of geotechnical data.

Table A 2.7 below presents the Commercial Fisheries Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.7 Commercial Fisheries Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	Hornsea Four array area construction activities and physical presence of constructed wind farm infrastructure leading to reduction in access to, or exclusion from established fishing grounds.	Tertiary Co89,Co90, Co91, Co92, Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of negligible to minor adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over construction period, though effect is short-term and localised, and the operational range of fleets is typically not limited to the array area.	**Scoped In** A detailed assessment based on baseline data analysis and consultation in order to characterise commercial fisheries activity in the study area and consider the dependence of fleets on grounds in the array area, and access to alternative grounds, and assess the effects of exclusion/reduced access .	Most up-to-date versions of publicly available data sources (e.g. UK landings data for 2017 will be available). Consultation with fleets active in the area to corroborate findings of data analysis and understand the specifics of fleet operation and grounds targeted.
Construction	Hornsea Four offshore cable corridor construction activities leading to reduction in access to, or exclusion from established fishing grounds.	Tertiary Co89, Co90, Co91, Co92, Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of negligible to moderate adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over construction period, though effect is short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.	**Scoped In** A detailed assessment approach will be adopted, as described above, and as relevant to the offshore ECC.	As above.
Construction	Displacement from Hornsea Four array area leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89, Co90, Co91, Co92, Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of negligible to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the array area.	**Scoped In** A detailed assessment approach will be adopted involving detailed analysis of multiple existing datasets and consultation with national (and international where relevant) fleets in order to characterise commercial fisheries activity in the study area and consider the potential nature and extent of displacement and implications for/of gear conflict.	As above.
Construction	Displacement from the Hornsea Four offshore cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89, Co90, Co91, Co92, Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of negligible to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.	**Scoped In** A detailed assessment approach will be adopted, as described above and as relevant to the offshore ECC.	As above.
Construction	Hornsea Four array area and offshore cable corridor construction activities leading to displacement or disruption of commercially	None	Minor	Medium	**No likely significant effects**	Scoped Out	N/A
Construction	Hornsea Four array area and Hornsea Four offshore cable corridor construction activities leading to additional steaming to alternative fishing grounds for vessels that would otherwise be fishing within the array and export cable areas.	Tertiary Co89, Co90, Co91, Co92, Co95	Fleet dependent; up to Minor	Fleet dependent; up to Low	**No likely significant effects**	Scoped Out	N/A
Construction	Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting construction vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor leading to interference with fishing activity.	Tertiary Co89, Co90, Co91, Co92, Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**No likely significant effects**	Scoped Out	N/A
Operation & Maintenance	Physical presence of Hornsea Four array area infrastructure leading to reduction in access to, or exclusion from established fishing grounds.	Primary Co81, Co83 Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of not significant to minor adverse significance, depending on fleet assessed. Assumes fishing can resume to a degree within the array area. Effect will be long-term but highly localised and operational range of most fishing vessels is not limited to the array area.	**Scoped In** A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	Most up-to-date versions of publicly available data sources (e.g. UK landings data for 2017 will be available for consideration). Consultation with fleets active in the area to corroborate findings of data analysis and understand the specifics of fleet operation and grounds targeted.
Operation & Maintenance	Physical presence of offshore export cable and infrastructure within the Hornsea Four offshore cable corridor leading to reduction in access to, or exclusion from established fishing grounds.	Primary Co81, Co83 Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Assumes fishing can resume to a degree within the array area. Effect will be long-term but highly localised and operational range of most fishing vessels is not limited to the offshore ECC.	**Scoped In** A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Operation & Maintenance	Displacement from Hornsea Four array area and Hornsea Four offshore cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds.	Primary Co81, Co83 Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95	Fleet dependent; up to Minor	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Assumes fishing can resume to a degree in array area and in vicinity of export cables. Effect will be highly localised and operational range of most fishing vessels is not limited to the array area or offshore ECC.	**Scoped In** A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Operation & Maintenance	Physical presence of Hornsea Four array area leading to gear snagging.	Primary Co81, Co83 Tertiary Co89, Co94, Co90, Co92, Co93, Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	**Likely significant effect without secondary mitigation** Effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Standard industry practice and protocol (i.e., seabed infrastructure will be buried and/or marked on charts) minimise this risk, but it remains likely to be an area of industry concern.	**Scoped In** A detailed assessment approach will be adopted involving detailed analysis of multiple existing datasets and consultation with national (and international where relevant) fleets in order to characterise commercial fisheries activity in the study area and consider the potential nature and extent of risk of gear snagging and associated implications.	As above.
		Primary			**Likely significant effect without secondary mitigation**	**Scoped In**	

Table A 2.7 Commercial Fisheries Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operation & Maintenance	Physical presence of the export cable and associated infrastructure leading to gear snagging.	Co81, Co83 Tertiary Co89 & Co94, Co90, Co91, Co92, Co93, Co95	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	Effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Standard industry practice and protocol (i.e., seabed infrastructure will be buried and/or marked on charts) minimise this risk, but it remains likely to be an area of industry concern.	A detailed assessment approach will be adopted, as described above and as relevant to the offshore ECC.	As above.
Operation & Maintenance	Hornsea Four operation and maintenance activities leading to displacement or disruption of commercially important fish and shellfish resources.	Primary Co81, Co83 Tertiary Co94	Minor	Medium	No likely significant effects	Scoped Out	N/A
Operation & Maintenance	Physical presence of the Hornsea Four array area and export cable leading to additional steaming to alternative fishing grounds for vessels that would otherwise be fishing within the Hornsea Four array area and offshore cable corridor.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95	Fleet dependent; Negligible	Fleet dependent; Low	No likely significant effects	Scoped Out	N/A
Operation & Maintenance	Increased vessel traffic within fishing grounds as a result of changes to shipping routes and maintenance vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor infrastructure leading to interference with fishing activity.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95	Fleet dependent; Negligible	Fleet dependent; Low	No likely significant effects	Scoped Out	N/A
Decomissioning	Hornsea Four array area decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95, Co111	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	Likely significant effect without secondary mitigation As described for the construction phase; effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over decommissioning period, though effect is short-term and localised, and the operational range of fleets is typically not limited to the array area.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	Most up-to-date versions of publicly available data sources (e.g. UK landings data for 2017 will be available for consideration). Consultation with fleets active in the area to corroborate findings of data analysis and understand the specifics of fleet operation and grounds targeted.
Decomissioning	Hornsea Four offshore export cable decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95, Co111	Fleet dependent; up to Moderate	Fleet dependent; up to Medium	Likely significant effect without secondary mitigation As described for the construction phase; effect likely to be of of not significant to moderate adverse significance, depending on fleet assessed. Potential for some loss of fishing opportunities over decommissioning period, though effect is short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Decomissioning	Displacement from Hornsea Four array area leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95, Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	Likely significant effect without secondary mitigation As described for the construction phase; effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the array area.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Decomissioning	Displacement from the Hornsea Four offshore cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95, Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	Likely significant effect without secondary mitigation As described for the construction phase; effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Potential for displacement of fishing activity, though effect will be short-term and localised, and the operational range of fleets is typically not limited to the offshore ECC.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during construction.	As above.
Decomissioning	Physical presence of any infrastructure left in situ leading to gear snagging.	Primary Co81, Co83 Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95, Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	Likely significant effect without secondary mitigation As described for the operation and maintenance phase; effect likely to be of of not significant to minor adverse significance, depending on fleet assessed. Standard industry practice and protocol (i.e., seabed infrastructure will be buried and/or marked on charts) minimise this risk, but it remains likely to be an area of industry concern.	Scoped In A detailed assessment approach will be adopted, as described above for the assessment of this impact during operation.	As above.
Decomissioning	Decommissioning activities leading to displacement or disruption of commercially important fish and shellfish resources.	None	Minor	Medium	No likely significant effects	Scoped Out	N/A
Decomissioning	Decommissioning activities leading to longer steaming distances to alternative fishing grounds.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95, Co111	Minor	Low	No likely significant effects	Scoped Out	N/A
Decomissioning	Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting decommissioning vessel traffic from Hornsea Four array area and Hornsea Four offshore cable corridor leading to interference with fishing activity.	Tertiary Co89, Co94, Co90, Co91, Co92, Co93, Co95, Co111	Fleet dependent; up to Minor	Fleet dependent; up to Medium	No likely significant effects	Scoped Out	N/A

Table A 2.8 below presents the Shipping and Navigation Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.8 Shipping and Navigation Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction and Decomissioning	Increased collision risk - presence of wind farm construction traffic increases the risk of collision between navigating vessels	Tertiary Co98, Co99, Co91	Moderate	Medium	Likely significant effect without secondary mitigation The additional construction traffic increases the likelihood of encounters. The impacts will most likely involve project vessels, with a lesser impact on	Scoped In A detailed assessment will be undertaken using analysis, consultation and collision risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Collision risk modelling Incident analysis Consultation
Construction and Decomissioning	Increased contact risk - presence of wind warm construction traffic increases the risk of contact between navigating vessels and array structures	Tertiary Co92, Co60, Co96, Co101, Co97, Co89, Co139, Co99, Co91	Moderate	Medium	Likely significant effect without secondary mitigation Additional structures which have not been fully commissioned increases risk of contact with project and transiting vessels.	Scoped In A detailed assessment will be undertaken using analysis, consultation and contact risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Contact risk modelling Incident analysis Consultation
Construction and Decomissioning	Impact on vessel routeing - array area causes deviations in shipping routes, increasing transit time.	Tertiary Co97, Co89	Moderate	Medium	Likely significant effect without secondary mitigation Deviations from shipping/ferry routes will result from the project. The increased distance travelled is not expected to be significant.	Scoped In A detailed assessment will be undertaken using analysis, consultation and route modelling to inform the NRA.	AIS data (One Year) Radar traffic surveys Vessel route Modelling Consultation
Construction and Decomissioning	Impact on SAR - array diminishes emergency response capability	Tertiary Co92, Co96, Co99	Minor	Low	Likely significant effect without secondary mitigation SAR will still be functional during construction given the embedded mitigation in place.	Scoped In A simple assessment will be undertaken.	
Construction and Decomissioning	Impact on radar, communications and navigation equipment - array structures impact on the communications and navigation equipment of navigating vessels,	Tertiary Co92, Co60, Co96, Co97	Minor	Negligible	Likely significant effect without secondary mitigation Presence of turbines is not expected to have a significant effect on a vessel's equipment.	Scoped In A simple assessment will be undertaken.	Desktop based impact assessment Consultation
Construction and Decomissioning	Impact on recreational activity - construction activities and array structures adversely affect the activities of recreational users.	Tertiary Co97, Co89, Co139, Co99, Co60, Co101	Negligible	Low	Likely significant effect without secondary mitigation Limited recreational activity in array area, impact is most likely during cable laying inshore of the offshore ECC.	Scoped In A simple assessment will be undertaken.	AIS data (one year) Radar traffic surveys Vessel route modelling Consultation
Construction and Decomissioning	Impact on fishing activity - construction activities and array structures adversely affect the activities of fishing users.	Tertiary Co97, Co89, Co139, Co99, Co60, Co101	Moderate	Low	Likely significant effect without secondary mitigation Periodic fishing activity in array area, impact is most likely during cable laying inshore of the offshore ECC	Scoped In A simple assessment will be undertaken.	Consultation Latest VMS/fisheries survey data
Construction and Decomissioning	Impact on Oil and Gas activity - construction activities and array structures adversely affect the activities of the oil and gas industry.	Tertiary Co97, Co89, Co139, Co99, Co60, Co101	Moderate	Low	Likely significant effect without secondary mitigation Oil and gas activity is principally clear of the array area, reducing the level of significance.	Scoped In A simple assessment will be undertaken.	
Construction and Decomissioning	Impact during cable laying - cable laying activities causes disruption and collision risk with other navigating vessels,	Tertiary Co139, Co98, Co99, Co100, Co91	Minor	Low	Likely significant effect without secondary mitigation Short duration of cable laying activities reduces the level of impact on other receptors.	Scoped In A simple assessment will be undertaken.	
Construction and Decomissioning	Anchor snagging risk with cable - partially constructed cable is snagged by a vessel anchor.	Tertiary Co139, Co98, Co99, Co100, Co91	Negligible	Medium	Likely significant effect without secondary mitigation Sparse anchoring in the study area reduces the likelihood of occurrence.	Scoped In A simple assessment will be undertaken.	
Construction and Decomissioning	Fishing gear snagging risk with cable - partially constructed cable is snagged by fishing gear.	Tertiary Co139, Co98, Co99, Co100, Co91	Minor	Medium	Likely significant effect without secondary mitigation Partially protected cable is vulnerable to snagging for a short period of time.	Scoped In A simple assessment will be undertaken.	
Construction and Decomissioning	Reduction in navigable depth - construction of the cable route reduces the navigable depth for vessel traffic.	Tertiary Co97, Co139), Co100, Co91	Negligible	Low	Likely significant effect without secondary mitigation Depths of water are generally significant and therefore no impact anticipated during project.	Scoped In A simple assessment will be undertaken.	Cable protection criteria.
Construction and Decomissioning	Contact risk with cable substation - construction of the substation increases contact risk with the structures.	Tertiary Co92, Co60, Co97, Co89, Co139, Co99, Co91	Moderate	Medium	Likely significant effect without secondary mitigation Isolated structure not fully commissioned will be located in a dense area of traffic.	Scoped In A detailed assessment will be undertaken using analysis, consultation and contact risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Contact risk modelling Incident analysis Consultation
Operation	Increased collision risk - presence of wind farm maintenance traffic increases the risk of collision between navigating vessels	Tertiary Co93, Co94, Co99	Minor	Medium	Likely significant effect without secondary mitigation Deviation of vessels could lead to increased collision risk, although given the available open waters this is not likely to be significant.	Scoped In A simple assessment will be undertaken to inform the NRA.	AIS data (one year) Radar traffic surveysIncident analysis Consultation
Operation	Increased contact risk - presence of wind Farm maintenance traffic increases the risk of contact between navigating vessels (including associated wind farm vessels) and array structures	Tertiary Co92, Co93, Co94, Co60, Co96, Co101, Co97, Co89, Co98, Co99, Co91	Minor	Medium	Likely significant effect without secondary mitigation Vessels will divert around the array with little transiting through.	Scoped In A detailed assessment will be undertaken using analysis, consultation and contact risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Contact risk modelling Incident analysis Consultation
	Impact on Vessel routeing - array area	Tertiary Co97, Co89			Likely significant effect without secondary mitigation Deviations from shipping/ferry routes will	Scoped In A detailed assessment will be	AIS data (one year) Radar traffic surveys

Table A 2.8 Shipping and Navigation Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operation	causes deviations in shipping routes, possibly increasing vessel transit time.		Moderate	Medium	result from the project. The increased distance travelled is not expected to be significant.	undertaken using analysis, consultation and route modelling to inform the NRA.	Vessel route modelling Consultation
Operation	Impact on SAR - array diminishes emergency response capability.	Tertiary Co84, Co92, Co96, Co99	Minor	Low	**Likely significant effect without secondary mitigation** SAR will still be functional during operation given the embedded mitigation in place.	**Scoped In** A simple assessment will be undertaken.	
Operation	Impact on radar, communications and navigation equipment - array structures impact on the communications and navigation equipment of navigating vessels,	Tertiary Co92, Co60, Co96, Co97	Minor	Negligible	**Likely significant effect without secondary mitigation** Presence of turbines is not expected to have a significant effect on a vessel's equipment.	**Scoped In** A simple assessment will be undertaken.	Desktop based impact assessment Consultation
Operation	Impact on recreational activity - maintenance activities and array structures adversely affect the activities of recreational users.	Tertiary Co97, Co89, Co99, Co60, Co101	Negligible	Low	**Likely significant effect without secondary mitigation** Limited recreational activity in array area, impact is most likely inshore of the cable route.	**Scoped In** A simple assessment will be undertaken.	AIS data (one year) Radar traffic surveys Vessel route modelling Consultation
Operation	Impact on fishing activity - maintenance activities and array structures adversely affect the activities of fishing users.	Tertiary Co97, Co89, Co99, Co60, Co101	Moderate	Low	**Likely significant effect without secondary mitigation** Periodic fishing activity in array area, impact is most likely during cable laying inshore of the cable route.	**Scoped In** A simple assessment will be undertaken.	Consultation Latest VMS/fisheries survey data
Operation	Impact on Oil and Gas activity - maintenance activities and array structures adversely affect the activities of the oil and gas industry.	Tertiary Co97, Co89, Co99, Co60, Co101	Moderate	Low	**Likely significant effect without secondary mitigation** Oil and gas activity is principally clear of the array area, reducing the level of significance.	**Scoped In** A simple assessment will be undertaken.	
Operation	Anchor snagging risk with cable - cable is snagged by a vessel anchor.	Tertiary Co81, Co83, Co99, Co100	Negligible	Medium	**Likely significant effect without secondary mitigation** Sparse anchoring in the study area reduces the likelihood of occurrence.	**Scoped In** A simple assessment will be undertaken.	
Operation	Fishing gear snagging risk with cable - cable is snagged by fishing gear.	Tertiary Co81, Co83, Co97, Co89, Co99, Co100	Minor	Medium	**Likely significant effect without secondary mitigation** Fishing along the cable route could lead to snagging.	**Scoped In** A simple assessment will be undertaken.	
Operation	Reduction in navigable depth – cable/protection reduces the navigable depth for vessel traffic.	Tertiary Co83, Co97, Co100	Negligible	Low	**Likely significant effect without secondary mitigation** Depths of water are generally significant and therefore no impact anticipated during project.	**Scoped In** A simple assessment will be undertaken.	Cable protection criteria
Operation	Contact risk with cable substation - the substation increases contact risk with the structures.	Tertiary Co92, Co60, Co97, Co89, Co99, Co91	Moderate	Medium	**Likely significant effect without secondary mitigation** Isolated structure not fully commissioned will be located in a dense area of traffic.	**Scoped In** A detailed assessment will be undertaken using analysis, consultation and contact risk modelling to inform the NRA.	AIS data (one year) Radar traffic surveys Contact risk modelling Incident analysis Consultation

Table A 2.9 below presents the Aviation and Radar Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.9 Aviation and Radar Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	WTG effects on civil and military radar systems during construction process	None	Nil	Negligible	**No likely significant effect**	**Scoped Out**	None
Operation and Maintenance	During operation WTG's in coverage areas of ADR systems could shield the radar from genuine targets of interest in WTG induced radar clutter. Furthermore, a degree of 'shadowing' could be created behind detectable WTG. Any of these potential effects could impact on the Air Defence Control ability to provide a safe and efficient service to aircraft and successfully utilise the radar data to monitor UK airspace from airborne threats.	None	Moderate	High	**Likely significant effect without secondary mitigation** Array area is potentially within the operational coverage of the Trimingham and Brizlee Wood ADR systems. WTG potentially detectable by ADR systems which would cause WTG induced radar clutter.	**Scoped In** A simple assessment will be completed. A radar line of sight (LOS) assessment will be completed to establish whether WTG parameters would be detectable by ADR systems. Consultation with the MOD will be required to understand operational impacts of potential detectability of WTG and to understand technical mitigation capability.	Final scheme design parameters for LOS analysis to establish the potential impacts on infrastructure and operations.
Construction and Decomissioning	WTG commissioning / decommissioning infrastructure may present physical obstruction effects on civil and military flight operations (including military Low Flying activity).	Tertiary Co102, Co105	Minor	Low	**No likely significant effect**	**Scoped Out**	None
All Phases	WTG in coverage areas of NATS PSR systems could shield the radar from genuine targets of interest in clutter and a degree of 'shadowing' could be created behind detectable WTG. Any of these potential effects could impact on the NATS provision of ATS to aircraft.	None	Moderate	Medium	**Likely significant effect without secondary mitigation** Array area is potentially within the operational coverage of the NATS Claxby and Cromer PSR systems. WTG potentially detectable by PSR systems.	**Scoped In** A simple assessment will be completed. A radar LOS assessment will be completed to establish whether WTG parameters will be detectable by these PSR systems. Consultation with the NATS will then be undertaken to understand operational impacts of potential detectability of WTG and to understand mitigation capability.	Final scheme design parameters for LOS analysis. to establish the potential impacts on infrastructure and operations.
All Phases	Hornsea Four array area is considered as being within the 9 NM consultation zone established for the oil & gas platforms to the north and southwest of the array area.	None	Moderate	Medium	**Likely significant effect without secondary mitigation** It is necessary to understand the impact on safe flight to these platforms, including constraints on helicopter flight profiles to ensure that appropriate access to platforms is maintained.	**Scoped In** A simple assessment will be completed to develop constrained areas where WTG would inhibit helicopter operations.	Final scheme design parameters for analysis to establish the potential impacts on infrastructure and operations.
All Phases	Offshore oil and gas platforms are supported by a number of helicopter operators who ferry crews and supplies to platforms from the mainland. The routes taken by helicopters on such flights may follow HMR which form a network of corridors between offshore platforms and the main support bases although these routes are not mandatory.	Tertiary Co102	Moderate	Medium	**Likely significant effect without secondary mitigation** A number of HMR routes are in proximity to the Hornsea Four array area. WTG and construction and decommissioning infrastructure may present physical obstruction impacts.	**Scoped In** A simple assessment will be completed to establish any physical obstructions that would inhibit helicopter operations.	Rochdale envelope parameters for analysis to establish the potential impacts on infrastructure and operations. .
All Phases	WTG and their commissioning / decommissioning infrastructure may present a physical obstruction and affect SAR helicopter flight operations. The development will lead to a change of the operating environment should an airborne SAR operation be required within or close to the array area.	Tertiary Co99, Co102, Co105	Minor	Low	**No likely significant effect**	**Scoped Out**	None
All Phases	Under aviation flight rules, the MSA is the altitude below which it is unsafe to fly in IMC (i.e. in poor visibility/cloud) owing to presence of terrain or obstacles within a specified area.	Tertiary Co102	Minor	Low	**No likely significant effect**	**Scoped Out**	None
All Phases	There is expected to be a requirement for Aviation Obstruction Lighting on the construction and decommissioning infrastructure and all or individual WTG based on CAA regulations. The fitting of appropriate lighting would ensure conspicuity of the WTG and infrastructure to stakeholders.	Tertiary Co99, Co102, Co105, Co106	Minor	Low	**No likely significant effect**	**Scoped Out**	None

Table A 2.10 below presents the Seascape and Visual Resources Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.10 Seascape and Visual Resources Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Construction	Offshore construction activities visible by day and night from offshore visual receptors.	None	Moderate to low	Low to medium to high	No likely significant effects	Scoped Out	None
					Likely significant effect without secondary mitigation	Scoped In Simple assessment of daytime effects of offshore HVAC booster substations where there may be construction views on both sides of vessels travelling along leisure sailing routes.	None
Construction	Offshore construction activities alter present day seascape character through physical and visual changes to the present-day seascape character.	None	Moderate to low	Low	No likely significant effects	Scoped Out	None
Construction	Offshore construction activities alter historic seascape character through physical changes to it.	None	Moderate to low	Generally low. Medium for Sea Surface Leisure sailing and Sub-sea floor Paleochannel sub-types	No likely significant effects	Scoped Out	None
Construction	Offshore construction activities cumulatively alter the visual resource and seascape character through changes (by day and night) to the seascape in the context of other offshore development.	None	Low	Generally low. Valued and sensitive receptors sited in areas close to shore are of medium sensitivity to cumulative effects.	No likely significant effects	Scoped Out	None
Operation and Maintenance	Offshore HVAC booster substations and Array Area visible by day and night from offshore visual receptors.	None	Moderate to low	Low to medium to high	No likely significant effects	Scoped Out	None
						Scoped In Simple assessment of daytime effects of offshore HVAC booster substations where there may be operational stage views on both sides of vessels travelling along leisure sailing routes.	
Operation and Maintenance	Offshore HVAC booster substations and Array Area alter seascape character through changes to the present-day seascape character.	None	Moderate to low	Low	No likely significant effects	Scoped Out	None
Operation and Maintenance	Offshore HVAC booster substations and Array Area alter seascape character through changes to the characteristics of the historic seascape character.	None	Moderate to low	Generally low. Medium for Sea Surface Leisure sailing and Sub-sea floor Paleochannel sub-types	No likely significant effects	Scoped Out	None
Operation and Maintenance	Offshore HVAC booster substations and Array Area cumulatively alter the visual resource and seascape character through changes to the seascape in the context of other offshore development.	None	Low	Generally low. Valued and sensitive receptors sited in areas close to shore are of medium sensitivity to cumulative effects.	No likely significant effects	Scoped Out	None
Decomissioning	Offshore decommissioning activities visible from offshore visual receptors.	None	Moderate to low	Low to medium to high	No likely significant effects	Scoped Out	None
					Likely significant effect without secondary mitigation	Scoped In Simple assessment of daytime effects of offshore HVAC booster substations where there may be construction views on both sides of vessels travelling along leisure sailing routes.	None
Decomissioning	Offshore decommissioning activities alter seascape character through changes to the present-day seascape character.	None	Moderate to low	Low	No likely significant effects	Scoped Out	None
Decomissioning	Offshore decommissioning activities alter seascape character through changes to the characteristics of the historic seascape character.	None	Moderate to low	Generally low. Medium for Sea Surface Leisure sailing and Sub-sea floor Paleochannel sub-types	No likely significant effects	Scoped Out	None
Decomissioning	Offshore decommissioning activities cumulatively alter the visual resource and seascape character through changes to the seascape in the context of other offshore development.	None	Low	Generally low. Valued and sensitive receptors sited in areas close to shore are of medium sensitivity to cumulative effects.	No likely significant effect	Scoped Out	None

Table A 2.11 below presents the Infrastructure and Other Users Impacts and Effects Register. This is a tool to aid a proportionate approach to the EIA and which will be developed alongside the design process as Hornsea Four proceeds. Effects that are judged to be not significant or of minor significance will be scoped out of further assessment in the EIA. The evidence basis for this judgement, together with embedded mitigation are described in the Scoping Report. Likely significant effects will be addressed through either a 'simple assessment' approach or a 'detailed assessment' approach (the approach is defined by each topic). The approach to baseline data collection, impact analysis methods etc are also defined at each topic level. Embedded mitigation measures are presented as either primary (an intrinsic part of the design), secondary (those measures that require further activity in order to achieve the anticipated outcome) or tertiary (which will be required regardless of the EIA as it is imposed e.g. as a result of legislative requirements and/or standard sectoral practices (e.g. via a CEMP)), and a full list of these measures can be found in either Annex B of this Scoping Report, or within each topic section.

Table A 2.11 Infrastructure and Other Users Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
All Phases	Aggregate dredging activities	Given that there are no licensed aggregate dredging sites within 30+km to the Hornsea Four array area or offshore ECC, impacts on aggregate dredging activity will be scoped out of any further consideration in the EIA process.				Scoped Out	N/A
All Phases	Disposal sites	As there are no active, licensed sites within or within 2km of the Hornsea Four array area (excluding the adjacent Hornsea One and Two sites) or offshore ECC, impacts on licensed disposal sites will be scoped out of any further consideration in the EIA process.				Scoped Out	N/A
All Phases	Impacts on the proposed Endurance CCS site	Given the current status of the CCS projects in the UK (and the planning refusal of the White Rose CCS project), impacts on the Endurance CCS site will be scoped out of any further consideration in the EIA process.				Scoped Out	N/A
Construction	Impacts on existing or proposed pipelines or cables or restrictions on access to pipelines or cables	Tertiary Co89, Co91, Co97, Co107	Minor	Medium	**No likely significant effect**	Scoped Out	N/A
Construction	Conflicts with oil and gas seismic survey activity within the Hornsea Four array area.	Tertiary Co89, Co91, Co97	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it. In addition, safety zones and advisory safety distances around the Hornsea Four array area may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Construction	Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four array area and within 500 m of the boundary of the Hornsea Four array area.	Tertiary Co89, Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Construction	Conflicts with oil and gas seismic survey activity along the Hornsea Four offshore ECC.	Tertiary Co89, Co91, Co97	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC scoping area. Safety zones around the potential offshore HVAC booster station(s) and advisory safety distances along the Hornsea Four offshore ECC corridor may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Construction	Restriction on oil and gas drilling and the placement of infrastructure within the offshore ECC and within 500 m of the boundary of the Hornsea Four ECC.	Tertiary Co89, Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC search area.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Construction	The piling of wind turbines and substation foundations will generate underwater noise that may cause acoustic interference with oil and gas seismic survey operations.	Tertiary Co89, Co97	Low	Low	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance	Temporary loss of access to existing or proposed pipelines or cables for repair or maintenance.	Tertiary Co89, Co91, Co97, Co107	Negligible	High	**No likely significant effect**	Scoped Out	N/A
Operation and Maintenance	Conflicts with oil and gas seismic survey activity within the Hornsea Four array area.	Tertiary Co89, Co97	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are 10 currently licenced blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it. The presence of infrastructure within the Hornsea Four array area may have an impact on the conduct of seismic surveys in the vicinity.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance	Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four array and within 500 m from the boundary of the Hornsea Four array area.	Tertiary Co89, Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are 10 currently licenced blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
	Conflicts with oil and gas seismic	Tertiary Co89, Co91, Co97	Dependent upon operator and location	The sensitivity of the receptor depends on the future seismic survey	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged.	Scoped In A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA.

Table A 2.11 Infrastructure and Other Users Impacts and Effects Register

Phase (Construction, O&M, Decommissioning)	Project Activity and Impact	Embedded Mitigation Measures	Magnitude	Importance / Sensitivity	Likely Significance of Effect at Scoping Stage and Justification	Proposed Approach to Assessment Scoped Out, Scoped In: Simple or Detailed)	Further Baseline Data Requirements
Operation and Maintenance	survey activity along the Hornsea Four offshore ECC.		operator and location, timing and design of seismic surveys.	on the future seismic survey requirements of the operators of each potentially affected block.	There are 12 currently licenced blocks coincident with the Hornsea Four offshore ECC search area. In the event that safety zones around the potential offshore HVAC booster station(s) are required during maintenance activities, these may have an impact on the conduct of seismic surveys in the vicinity.		In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance	Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four offshore ECC and within 500 m from the boundary of the Hornsea Four offshore ECC.	Tertiary Co89, Co97	Dependent upon operator.	The sensitivity of the receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are 12 currently licenced blocks coincident with the Hornsea Four offshore ECC search area.	**Scoped In** A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Operation and Maintenance	Interference with the performance of the REWS located on oil and gas platforms.	Tertiary Co89, Co97	Dependent upon platform location, proximity, and the characteristics of the REWS system.	Potentially high where the performance of a REWS system is significantly affected.	**Likely significant effect without secondary mitigation** The presence of the Hornsea Four turbines in previously open sea has the potential to cause significant interference with the performance of REWS located on oil and gas platforms. There are several platforms with REWS in the vicinity of the Hornsea Four array area which have the potential to be affected by the wind turbines within it.	**Scoped In** Detailed Assessment. Consultation with each of the relevant platform operators will be undertaken to inform the assessment.	Consultation with each potentially affected platform operator will be undertaken to inform the assessment and identify and characterise REWS systems. Modelling of impacts on REWS will be undertaken by Manchester University.
Operation and Maintenance	The presence of new wind turbines in previously open sea areas will deviate vessels which may cause a change in Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) alarms on oil and gas platforms protected by REWS.	Tertiary Co89, Co97	Dependent upon platform location, proximity and the characteristics of the REWS system and corresponding vessel routeing and activity.	Potentially high where risk of vessel collision is increased due to significant impacts on the performance of a REWS system.	**Likely significant effect without secondary mitigation** Dependant on location of platform and effects on REWS and corresponding change to vessel collision risk.	**Scoped In** Detailed Assessment. Consultation with each of the relevant platform operators will be undertaken to inform the assessment.	Consultation with each potentially affected platform operator will be undertaken to inform the assessment, and to identify and characterise REWS systems. Modelling of impacts on REWS will be undertaken by Manchester University. This will be integrated into the shipping and navigation assessment in relation to potential collision risk.
Operation and Maintenance	Wind turbines and associated infrastructure will form a physical obstruction and may disrupt vessel access to oil and gas platforms and subsurface infrastructure.	Tertiary Co89, Co94, Co97	Dependent upon platform location and proximity and corresponding vessel routeing and activity.	Potentially high (for the Hornsea Four array) where vessel access to platforms and subsurface infrastructure is restricted. No impact from Hornsea Four offshore ECC in operation.	**Likely significant effect without secondary mitigation** Dependent on location of platform and effects on vessel access relative to the Hornsea Four array.	**Scoped In** A simple assessment will be adopted (for Hornsea Four array only). Scoped out of further assessment for Hornsea Four offshore ECC.	Consultation with each potentially affected platform operator will be undertaken to inform the assessment. To be informed by the Shipping and Navigation assessment process (see section 7.9).
Decomissioning	Impacts on existing or proposed pipelines or cables or restrictions on access to pipelines or cables	Tertiary Co89, Co91, Co97, Co107, Co111, Co139	Minor	High	**No likely significant effect**	**Scoped Out**	N/A
Decomissioning	Conflicts with oil and gas seismic survey activity within the Hornsea Four array area.	Tertiary Co89, Co91, Co97, Co111	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it. In addition, safety zones and advisory safety distances around the Hornsea Four array area may have an impact on the conduct of seismic surveys in the vicinity.	**Scoped In** A simple assessment will be adopted. Consultation with each of the relevant platform operators will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decomissioning	Restriction on oil and gas drilling and the placement of infrastructure within the Hornsea Four array area and within 500 m of the boundary of the Hornsea Four array area.	Tertiary Co89, Co97, Co111	Dependent upon operator.	The sensitivity of the receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 10 licensed blocks coincident with the Hornsea Four array area and a 500 m buffer surrounding it.	**Scoped In** A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decomissioning	Conflicts with oil and gas seismic survey activity along the Hornsea Four offshore ECC.	Tertiary Co89, Co97, Co111	Dependent upon operator and location, timing and design of seismic surveys.	The sensitivity of the receptor depends on the future seismic survey requirements of the operators of each potentially affected block.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC scoping area. Safety zones around the potential offshore HVAC booster station(s) and advisory safety distances along the Hornsea Four offshore ECC corridor may have an impact on the conduct of seismic surveys in the vicinity.	**Scoped In** A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decomissioning	Restriction on oil and gas drilling and the placement of infrastructure within the offshore ECC and within 500 m of the boundary of the Hornsea Four ECC.	Tertiary Co89, Co97, Co111	Dependent upon operator.	The sensitivity of the receptor depends on their licenced acreage affected and the future plans of the licence operator in relation to development activity.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future development activity is acknowledged. There are currently 12 licenced blocks coincident with the Hornsea Four offshore ECC search area.	**Scoped In** A simple assessment approach will be adopted. Consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.
Decomissioning	The piling of wind turbines and substation foundations will generate underwater noise that may cause acoustic interference with oil and gas seismic survey operations.	Tertiary Co89, Co97, Co111	Low	Low.	**Likely significant effect without secondary mitigation** Likely to be not significant with the embedded mitigation, although uncertainty as to future seismic survey requirements is acknowledged.	**Scoped In** A simple assessment approach will be adopted. Underwater noise modelling will also be undertaken to inform the assessment. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.	The BEIS, OGA and UK Oil and Gas Data datasets will be used to inform the infrastructure and other marine users EIA. In addition, consultation with each potentially affected licence block operator will be undertaken to inform the assessment.

Hornsea 4

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Environmental Impact Assessment: Scoping Report

Annex B Commitments Register

Reference	Project Element					Activity	Project Stage Commitment / Priority	Hornsea Project 4 Commitment	Onshore Topic relevance								Offshore Topic relevance										Classification	Where is the approved commitment secured
	Onshore ECR	Offshore ECR	Landfall	Onshore Substation	Array				Geology & Ground Conditions	Hydrology & Flood Risk	Historic Environment	Land Use & Recreation	LVIA	Noise & Vibration	Ecology	Air Quality & Health	Traffic & Transport	Marine Processes	Benthic	Offshore & Intertidal Ornithology	Fish & Shellfish	Marine Mammals	Commercial Fisheries	Ship & Nav	Marine Archaeology	Seascape & Visual Resource	Infra & Other Users		
Co1	X		X	X		Construction	RPSS	All natural watercourses including main rivers and ordinary watercourses (not artificial drainage ditches, flood defences), main roads and railways will be crossed by HDD or other trenchless technology where technically practical.	X	X			X		X		X												Primary	CoCP and DCO requirement
Co2	X		X	X		Construction	RPSS	Where practical the following sensitive sites will be avoided by the permanent project footprint: SSSI Units, Ancient woodland, areas of consented development, areas of historic landfill and other known areas of potential contamination, RSPB reserves, Local Nature Reserves, Local Wildlife Sites, Yorkshire Wildlife Trust Sites, National Trust Land, Listing Buildings and Scheduled Monuments. Where possible, unprotected areas of woodland, mature and protected trees (those with Tree Preservation Orders TPOs) shall also be avoided.	X		X		X		X														Primary	DCO Works Plans and Order limits
Co7	X					Construction	Scoping	The construction working area will typically be 80m working width along the underground cable route to minimise the construction footprint. Other crossings may expand this default to greater than 80m (HDD and local factors, over small lengths). The permanent width will be 60m.	X				X		X														Tertiary	DCO Works Plans and Order limits
Co10	X		X	X		Construction	Scoping	Post-construction the working area will be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298.	X	X	X	X	X															Tertiary	CoCP and DCO requirement
Co22	X		X	X		Construction	Scoping	The following applies to both construction and operation: Refuelling of machinery will be undertaken within designated areas where spillages can be easily contained. Machinery will be routinely checked to ensure it is in good working condition. Any tanks and associated pipe work containing oils and fuels will be double skinned and be provided with intermediate leak detection equipment. Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) will be bunded and carefully sited to minimise the risk of hazardous substances entering the drainage system or the local watercourses. Additionally the bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage. Bunds used will store fuel, oil etc. to have a 110% capacity. Disturbance to areas close to watercourses reduced to the minimum necessary for the work. Excavated material will be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into the watercourses. Construction materials will be managed in such a way as to effectively minimise the risk posed to the aquatic environment. All plant machinery and vehicles will be maintained in a good condition to reduce the risk of fuel leaks. Drainage works to be constructed to relevant statutory guidance and approved via the Lead Local Flood Authority prior to the commencement of construction. Consultation with the Environment Agency to be ongoing throughout the construction period to promote best practice and to implement proposed mitigation measures.	X																				Tertiary	CoCP and DCO requirement
Co25	X					Construction	RPSS	The onshore cable route will be completely buried underground for its entire length.	X	X			X		X														Primary	DCO Works Plans, description of development and requirements
Co26	X		X	X		Construction	Scoping	Hedgerows and vegetation will be retained where possible. Where it is not possible to retain them, hedgerows will be removed prior to topsoil removal. The width of hedge and vegetation removed will be limited where practical.					X		X														Primary	DCO Works Plans and CoCP
Co28	X		X			Construction	Scoping	Joint Bays will be completely buried, with the land above reinstated excepting link box chambers where access will be required from ground level, e.g. via manholes.	X				X														Primary	DCO Works Plans, description of development and requirements
Co33	X		X	X		Construction	Scoping	Where removal of vegetation has to be undertaken during the bird breeding season, vegetation will be checked by a suitably qualified ecologist and where nests are present, the vegetation will not be removed until the chicks have fledged.																				Tertiary	CoCP and DCO requirement
Co34	X		X	X		Construction	Scoping	Where HDD technologies are not required or practical, the crossing of drainage ditches may be undertaken by open cut methods and / or the installation of temporary culverts or bridges to allow water to continue flowing. This will be in line with advice notes, guidance documents and additional information including Environment Agency Pollution Prevention Guidelines (PPGs) will be adhered to, particularly: • PPG01 General Guide to the Prevention of Water Pollution; • PPG02 Above Ground Oil Storage Tanks; • PPG04 Disposal of Sewage where no Mains Drainage is Available; • PPG05: Works in, Near or Liable to Affect Watercourses; • PPG06: Working at Construction and Demolition Sites; • PPG08 Safe Storage and Disposal of Used Oils; • PPG21: Pollution Incident Response Planning; and • Pollution Prevention: Major Pipeline.		X					X													Primary	CoCP and DCO requirement
Co36	X		X	X		Construction	Scoping	Core working hours for the construction of the onshore components of Hornsea Four will be as follows: • Monday to Friday: 07:00 - 18:00 hours; • Saturday: 07:00 - 13:00 hours; • Up to one hour before and after core working hours for mobilisation ("mobilisation period"), i.e. 06:00 to 19:00 weekdays and 06:00 to 14:00 Saturdays; and • Maintenance period 13:00 to 17:00 Saturdays. *Activities carried out during mobilisation and maintenance will not generate significant noise levels (such as piling, or other such noisy activities).* In certain circumstances, specific works may have to be undertaken outside the normal working hours - such as: • Horizontal Directional Drilling (HDD) or other trenchless construction operations which may require 24 hour machinery operation, dependent on the ground conditions; • Remedial works, for example in the event of severe weather; • Delivery of electrical infrastructure; • Jointing operations along the cable route; and • Security of sites and protection of open assets. We will inform ERYC in writing.							X	X												Primary	CoCP and DCO requirement
Co41	X		X			Construction	Scoping	All trenchless crossings will be undertaken by non-impact methods and, as such, construction vibration will be unlikely to be significant beyond the immediate location of works. No blasting is anticipated.	X					X		X												Primary	CoCP and DCO requirement
Co44		X				Construction	RPSS	The Holderness Inshore Marine Conservation Zone (MCZ) (designated for Intertidal sand and muddy sand, Moderate energy circalittoral rock, High energy circalittoral rock, Subtidal coarse sediment, Subtidal mixed sediments, Subtidal sand, Subtidal mud, and Spurn head (subtidal)) will be avoided by marine ECR.									X	X								X	Primary	Secured by means of the Order limits as defined in the DCO and dMLs.
Co45		X				Construction	RPSS	The Holderness Offshore recommended MCZ (rMCZ) (proposed to be designated for North Sea Glacial Tunnel valleys, Subtidal coarse sediment, Subtidal sand, Subtidal mixed sediments and Ocean Quahog (*Arctica islandica*)) will be avoided by marine ECR.									X	X								X	Primary	Secured by means of the Order limits as defined in the DCO and dMLs.
Co46		X			X	Construction	RPSS	The marine ECC (including WTGs and inter-array cables) will be routed so as to avoid any known wrecks (with a buffer of 50m around wreck), further refined following high-resolution geophysical survey post-consent.																	X			Primary	Secured in the dMLs through the requirement for a Design Plan.

Co49	X		X	X		Construction	Scoping	There will be no permanent High Voltage infrastructure installed above surface within 50m of residential properties and sub surface within 25m of residential properties.					X															Primary	DCO Works Plans
Co64	X		X	X		Construction	Scoping	During construction of the cable trenches the topsoil and subsoil will be stripped and stored on site within the temporary working corridor of the Hornsea Four onshore cable corridor. The topsoil and subsoil will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). No material will be stockpiled within the floodzone of any watercourse.	X	X			X			X													Tertiary	CoCP and DCO requirement
Co76	X		X	X		Construction	Scoping	Potential risks to human health from any encountered (unexpected) ground contamination will be avoided by the use of appropriate Personal Protective Equipment (PPE) and by adopting appropriate working practices.	X																			Tertiary	CoCP
Co77	X		X	X		Construction	Scoping	Any contamination encountered during the construction phase would be subject to appropriate risk assessment and if necessary, either removed, treated and/ or mitigated as part of the project.	X																			Tertiary	CoCP
Co78	X		X	X		Construction	Scoping	Micro-siting will be undertaken during detailed design to avoid all ponds if practical.					X		X													Primary	DCO Works Plans
Co79	X		X	X		Construction	Scoping	Signage and/or temporary PRoWs/footpath diversions will be provided during construction.				X					X											Primary	CoCP
Co80	X		X	X		Construction	Scoping	A crossing schedule is provided which includes crossing methodology for each crossing of road, rail, PRoW and watercourse.		X		X					X											Primary	DCO requirement and description of development
Co81		X			X	Construction	Scoping	A scour protection layer (typically rock) may be needed where cable burial depths cannot be obtained.																X	X			X	Primary	Secured in the dMLs through the requirement for a Scour Protection Management Plan (SPMP) and Cable Specification and Installation Plan (CSIP).
Co82					X	Construction	Scoping	A scour protection layer (typically rock) may be needed on the seabed and would be installed either before or after foundation installation.											X									Primary	Secured in the dMLs through the requirement for a Scour Protection Management Plan (SPMP).
Co83	X	X				Construction	Scoping	Undertake a cable burial risk assessment to inform front end engineering works. Cable burial will be the preferred option for cable protection.												X		X		X	X				Primary	Secured in the dMLs through the requirement for a Cable Specification and Installation Plan (CSIP).
Co84		X			X	Construction	Scoping	Foundations and cable routes will be micro-sited around qualifying sensitive habitat features (subject to agreement with the MMO) to an extent not resulting in a hazard for marine traffic and Search & Rescue capability. Presence of sensitive habitats will be identified through a review of the latest available benthic datasets and pre-construction surveys.													X					X				Primary	Secured in the dMLs through the requirement for a Design Plan.
Co86		X	X			Construction	Scoping	The proposed offshore cable corridor and cable landfall (below MHWS) will avoid all statutory marine designated areas.												X	X							Primary	Secured by means of the Order limits as defined in the DCO and dMLs.
Co88		X			X	Construction	Scoping	Construction and operational maintenance vessels (eg CTVs) will follow a route from their home port that avoids high concentrations of red-throated diver (a species known to be sensitive to disturbance by boat traffic).													X						X	Tertiary	Secured in the dMLs through the requirement for a Construction Method Statement (CMS).
Co89		X			X	Construction	Scoping	Advance warning and accurate location details of construction/maintenance/decommissioning operations and associated Safety Zones and advisory safety distances will be given to fishing fleets (including via Notices to Mariners and Kingfisher Bulletins).																X	X			X	Tertiary	Secured in the dMLs through the requirements for notifications.
Co90		X			X	Construction	Scoping	Ongoing liaison with fishing fleets will be maintained during construction/maintenance/decommissioning operations via an appointed Fisheries Liaison Officer and Fishing Industry Representative.																X					Tertiary	Secured in the dMLs through the requirement for a Project Environmental Management and Monitoring Plan (PEMMP) and Fisheries Co-Existence and Liaison Plan (FCLP).
Co91		X			X	Construction	Scoping	Guard vessels will be used, where appropriate, during construction/maintenance/decommissioning operations to ensure communication of and adherence to Safety Zones and advisory safety distances.																X	X			X	Tertiary	Secured in the dMLs through the requirement for a Construction Method Statement (CMS) and through the application for Safety Zones.
Co92		X			X	Construction	RPSS	All infrastructure (including partially constructed/decommissioned) will be designed, marked and lit in accordance with standard industry guidance including MGN 543 and as advised by IALA and Trinity House.																X	X			X	Tertiary	Secured in the dMLs through the requirement for an Aid to Navigation Management Plan (ANMP).
Co93		X			X	Construction	RPSS	Aids to navigation will be deployed in accordance with standard industry guidance.																X	X			X	Tertiary	Secured in the dMLs through the requirement for an Aid to Navigation Management Plan (ANMP).
Co94		X			X	Construction	RPSS	Notifications will be made to the relevant bodies (e.g. United Kingdom Hydrographic Office) to allow marking of all installed infrastructure on charts.																X	X			X	Tertiary	Secured in the dMLs through the requirements for notifications.
Co95		X			X	Construction	Scoping	A fisheries co-existence and liaison plan will be prepared in advance of construction commencing.																X				X	Tertiary	Secured in the dMLs through the requirement for a Fisheries Co-Existence and Liaison Plan (FCLP).
Co96					X	Construction	Scoping	Maintaining at least one line of symmetry/orientation in turbine layout																	X			X	Primary	Secured in the dMLs through the requirement for a Design Plan.
Co98		X			X	Construction	Scoping	Construction monitoring and coordination for project vessels.																	X			X	Tertiary	Secured in the dMLs through the requirement for construction vessel traffic monitoring.
Co99		X			X	Construction	Scoping	Development of Emergency Response and Cooperation Plan (ERCOP)																	X			X	Tertiary	Secured in the dMLs through the requirement for an Emergency Response Co-operation Plan (ERCoP).
Co101					X	Construction	Scoping	Air draught clearance of blades greater than 22m 23,8m MSL													X				X			X	Primary	Secured in the dMLs through the requirement for a Design Plan.
Co102					X	Construction	Scoping	Notification to aviation stakeholders of the location and height of all wind energy development and associated construction activities (all structures over 150 ft).																				X	Tertiary	Secured in the dMLs through the requirements for notifications.
Co105					X	Construction	Scoping	All structures (turbines and offshore support platforms) above 60 m in height to be fitted with aviation obstruction lighting.																				X	Tertiary	Secured in the dMLs through the requirement for an Aid to Navigation Management Plan (ANMP).
Co106					X	Operation and maintenance	Scoping	Turbines to be accessed by hoist will be equiped with a helihoist status light on each turbine to indicate to a helicopter operator that the turbine blades and nacelle are safely secured in position prior to helicopter hoist operations commencing.																				X	Tertiary	Secured in the dMLs through the requirement for an Aid to Navigation Management Plan (ANMP).
Co107		X			X	Construction	Scoping	Crossing and proximity agreements with known existing pipeline and cables operators.																				X	Tertiary	Secured by commercial agreements with pipeline and cable operators.

Co108		X			X	Construction	Scoping	A vessel management plan will be developed which will determine vessel routing to and from construction areas and ports to avoid areas of high risk. This will also include codes of conduct for vessel behaviour and for vessel operators including advice to operators to not deliberately approach marine mammals and to avoid abrupt changes in course or speed should marine mammals approach the vessel to bow-ride.														X								Tertiary	Secured in the dMLs through the requirement for a Project Environmental Management and Monitoring Plan (PEMMP).
Co109					X	Construction	Scoping	During piling operations, soft starts will be used, with lower hammer energies used at the beginning of the piling sequence before increasing energies to the higher levels.											X		X	X						Tertiary	Secured in the dMLs through the requirement for a Marine Mammal Mitigation Protocol (MMMP).
Co110					X	Construction	Scoping	A piling MMMP, approved by the MMO in consultation with Natural England, will be implemented during construction. The MMMP will outline monitoring measures to ensure the impact zone is free of marine mammals before piling commences. The details of the MMMP will be agreed with Natural England.														X						Tertiary	Secured in the dMLs through the requirement for a Marine Mammal Mitigation Protocol (MMMP).
Co111		X			X	Construction	Scoping	A PEMMP (construction and operation phases) and Decommissioning Plan (decommissioning phase) will be produced and followed. The PEMMP and Decommissioning Plan will cover the construction, operation and maintenance, and decommissioning phases of Hornsea Four respectively and will include a Marine Pollution Contingency Plan (MPCP). This MPCP will outline procedures to protect personnel working and to safeguard the marine environment in the event of an accidental pollution event arising from offshore operations relating to Hornsea Four. The MPCP will also outline mitigation measures should an accidental spill occur, address potential contaminant releases and include key emergency contact details (e.g. Environment Agency, Natural England and MCA).											X		X	X	X				X	Tertiary	Secured in the dMLs through the requirement for a Project Environmental Management and Monitoring Plan (PEMMP) and Decommissioning Programme.
Co112		X			X	Construction	Scoping	A UXO specific MMMP, approved by the MMO in consultation with Natural England will be implemented during UXO clearance. The UXO MMMP will use ADDs, marine mammal observers and scare charges as the primary mitigation measures alongside other measures as may be agreed with Natural England and the MMO.														X					X	Tertiary	Secured in the dMLs through the requirement for a Marine Mammal Mitigation Protocol (MMMP).
Co113		X			X	Decommissioning	Scoping	A Decommissioning MMMP, approved by the MMO in consultation with Natural England, will be implemented during decommissioning. The MMMP will outline monitoring measures to ensure the impact zone is free of marine mammals before decommissioning activities commences. The details of the MMMP will be agreed with Natural England.														X						Tertiary	Secured in the dMLs through the requirement for a Decommissioning Programme.
Co114	X		X	X		Construction	Scoping	Best practice air quality management measures will be applied as described in Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction 2014, version 1.1, where relevant and practicable to the activities being undertaken.							X	X												Tertiary	CoCP and DCO requirement
Co116	X		X	X		Construction	Scoping	Any contamination encountered during the construction phase would be subject to appropriate risk assessment and if necessary, either removed, treated and/ or mitigated as part of the project.																				Tertiary	CoCP and DCO requirement
Co123	X		X	X		Construction	Scoping	Based on noise modelling results, where noise has the potential to cause disturbance the use of mufflers, acoustic barriers and directional lighting for areas where HDD is undertaken.						X	X													Tertiary	CoCP and DCO requirement
Co124	X		X	X		Construction	Scoping	Adoption of an agreed Construction Code of Practice to minimise temporary disturbance to residential properties, recreational users, and existing land users.				X				X	X											Tertiary	CoCP and DCO requirement
Co127	X		X	X		Construction	Scoping	A Decommissioning Plan or method statement will be agreed with the removal of all onshore above ground infrastructure.				X	X				X											Tertiary	DCO requirement
Co128	X		X	X		Construction	Scoping	Appropriate sites will be selected through the RPSS process for onshore construction compounds. Good construction practice will be applied.					X															Primary	DCO Works Plans, CoCP and DCO requirement
Co133	X					Construction	Scoping	The onshore ECC will be routed to avoid noise sensitive properties avoided by at least 50 m.						X														Primary	DCO Works Plans and Order limits
Co134			X			Construction	Scoping	Cable installation works at the landfall area will be located at least 200 m from noise sensitive properties.						X														Primary	DCO Works Plans and Order limits
Co135	X					Construction	Scoping	Construction access roads along the onshore ECC will be located at least 150 m from noise sensitive properties.						X														Primary	DCO Works Plans and Order limits
Co137	X		X	X		Operation and maintenance	Scoping	Vehicle movements associated with operation and planned maintenance of the onshore infrastructure will operate only during the daytime and evening periods (i.e. 0700 – 2300). Vehicle movements-may however be subject to unscheduled events outside these hours						X														Tertiary	CoCP
Co138					X	Operation and maintenance	Scoping	Raised lower airdraft of WTG turbines to minimum of 35 m MSL instead of 22 m LAT												X							Primary	Secured in the dMLs through the requirement for a Design Plan.
Co139		X			X	Construction	Scoping	Application and use of safety zones of up to 500m during construction/maintenance and decommissioning phases .																X			X	Tertiary	Secured by the application for Safety Zones prior to the commencement of construction.
Co140		X			X	Construction	Scoping	Establishment of archaeological exclusion zones (AEZs) as required to protect any known / identified marine archaeological receptors.																	X			Secondary	Secured in the dMLs through the requirement for a Written Scheme of Archaeological Investigation (WSI).
Co141		X			X	Construction	Scoping	Development and agreement of an archaeological WSI, including the development and implementation of a Protocol for Archaeological Discoveries in accordance with 'Protocol for Archaeological Discoveries: Offshore Renewables Projects' (The Crown Estate, 2014).																	X			Tertiary	Secured in the dMLs through the requirement for a Written Scheme of Archaeological Investigation (WSI).
Co142		X			X	Construction	Scoping	A programme of geoarchaeological assessment and analysis will be undertaken on geotechnical samples collected across the ECC and array area, which will include early engagement with the geoarchaeologist to optimise sample locations, and will result in the delivery of a paleogeographic ground-model.																	X			Tertiary	Programme of geoarchaeological assessment and analysis to be agreed via the Evidence Plan process.

Hornsea 4

Ørsted



Environmental Impact Assessment: Scoping Report

Annex C Topic Assessment Methodologies

Marine Geology, Oceanography and Physical Processes

Definitions—what does it involve?

Marine Geology, Oceanography and Physical Processes-

Identifies all marine geology, oceanography and physical process of relevance to Hornsea Four. In most cases, changes in physical processes are generally considered as 'sources' of a change and 'pathways' for effects which have the potential to influence other environmental 'receptors'. In some cases, a physical process feature can also be considered directly as a receptor, such as the adjacent shoreline or a designated habitat feature such as a subtidal sandbank, or a water body feature with a biological interest.





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Marine Geology, Oceanography and Physical Processes baseline to understand the existing situation

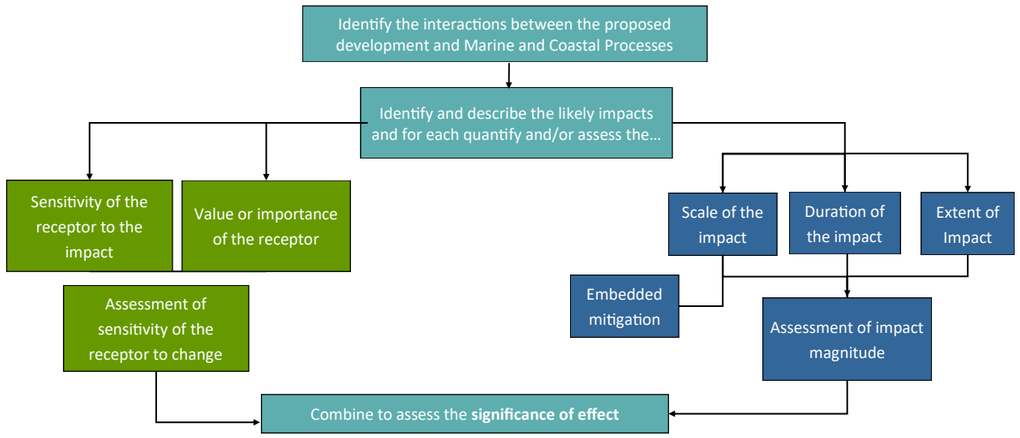
The physical processes study area for Hornsea Four is defined as the Hornsea Four array area within which the foundations for WTGs and offshore platforms and inter-array cables will be located and offshore export cable corridor (offshore ECC) from the Hornsea Four array area up to the landfall. It also includes the surrounding areas where there may be disposal of sediments, where disturbed sediments may be transported and settle on the sea-bed, or where wave and tidal wake effects may propagate away from foundations (beyond the Hornsea Four array area) to interfere with other features.

A desk-based review of literature and existing data sources was undertaken which includes (but is not limited to) the following data sources:

- Hornsea Zonal /Projects Characterisation (Smart Wind 2012);
- Existing wave and tidal models extending over the study area (SMart Wind, 2015a), (SMart Wind, 2015b) and (Ørsted, 2018) ;
- Atlas of UK Marine Renewable Energy for supporting descriptions of regional variations in waves and tides (DECC, 2008);
- The European Marine Observation and Data Network (EMODnet);
- Southern North Sea Sediment Transport Study (HR Wallingford, CEFAS/UEA, Posford Haskoning, and Brian D'Olier, 2002);
- UK Offshore Energy Strategic Environmental Assessment. Phase 3 (OESEA3) for regional sea description, (DECC, 2016);
- Sand banks, sand transport and offshore wind farms (Kenyon & Cooper, 2005);
- Flamborough Head to Gibraltar Point Shoreline Management Plan (Scott Wilson, 2010);
- Nearshore seabed survey: Flamborough Head to Spurn Point (Channel Coastal Observatory, 2014);
- Suspended sediment mapping (CEFAS, 2016); and
- Temperature modelling and mapping of frontal development from (Connor, et al., 2006), (van Leeuwen, Tett, Mills, & van der Molen, 2015) and Copernicus Marine Environmental Monitoring Service.

Step 2

For each impact…



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Marine Geology, Oceanography and Physical Processes

Assess the significance of the residual effect.

Value/ Importance and Sensitivity of Receptor

Value	Criteria
Very High	Receptor is high value or critical importance to local, regional or national economy or environment. Receptor is highly vulnerable to impacts that may arise from the project and recoverability is long term or not possible
High	Receptor is of moderate value with reasonable contribution to local, regional or national economy or environment. Receptor is generally vulnerable to impacts that may arise from the project and / or recoverability is slow and/or costly.
Medium	Receptor is of minor value with small levels of contribution to local, regional or national economy or environment. Receptor is somewhat vulnerable to impacts that may arise from the project and has moderate to high levels of recoverability.
Low	Receptor is of low value with little contribution to local, regional or national economy or environment. Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.
Negligible	Receptor is of negligible value with no contribution to local, regional or national economy or environment. Receptor is not vulnerable to impacts that may arise from the project and/or has high recoverability.

Magnitude of Impact

Magnitude	Criteria
Major	Total loss of function. Impact is of extended temporal or physical extent and/or of long-term duration (i.e. approximately >20 years duration).
Moderate	Loss or alteration to significant portions of key components of current function. Impact is of moderate temporal or physical extent and/or of medium-term duration (i.e. two to 20 years).
Minor	Minor shift away from baseline, leading to a change in function. Impact is of limited temporal or physical extent and/or of short-term duration (i.e. less than two years).
Negligible	Very slight change from baseline condition. Physical extent of impact is negligible and / or of short-term duration (i.e. less than two years).
No change	No change from baseline conditions.

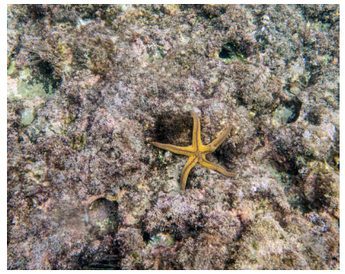
Benthic and Intertidal Ecology

Definitions—what does it involve?

Benthic and Intertidal Ecology—

Identifies the benthic and intertidal ecology receptors of relevance to Hornsea. This includes benthic species and habitats and their interactions.





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Benthic and Intertidal Ecology baseline to understand the existing situation

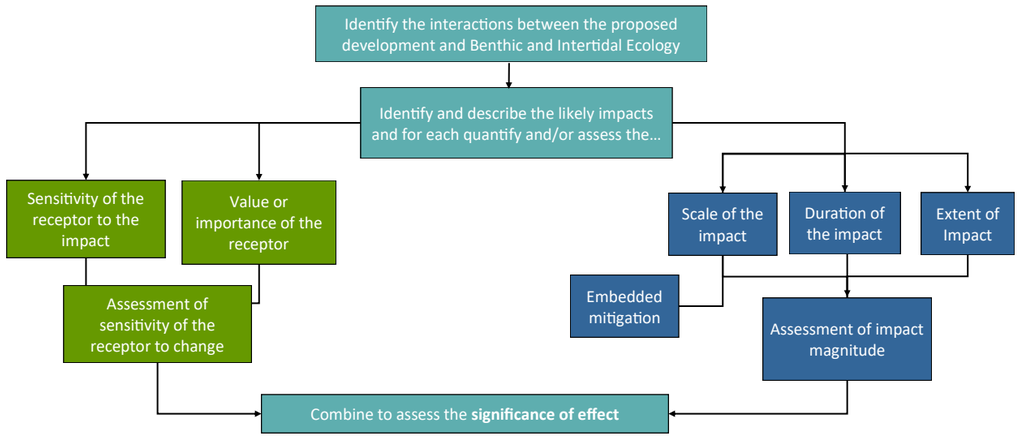
The study area encompasses the Hornsea Four array area along with the Hornsea Project One, Hornsea Project Two and Hornsea Three array areas and a 5 km buffer zone to the north and south. The study area also includes the offshore Export Cable Corridor (ECC) up to and including the intertidal zone ending at Mean High Water Springs (MHWS). Potential effects from construction, operation (including maintenance) and decommissioning of the offshore components of Hornsea Four on benthic and intertidal ecology.

A desk-based review of literature and existing data sources was undertaken which includes (but is not limited to) the following data sources:

- Hornsea Zonal/ Project Characterisation surveys;
- Creyke Beck Environmental Statement (Forewind, 2013);
- Humber Regional Environmental Characterisation (REC) (Tappin et al., 2012);
- Technical reports for Strategic Environmental Assessment (SEA) Areas 2 and 3 (Department of Trade and Industry (DTI), 2001a; DTI, 2001b); and
- EMODnet broad-scale seabed habitat map for Europe (EUSeaMap) (EMODnet, 2016).

Step 2

For each impact...



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Benthic and Intertidal Ecology.

Assess the significance of the residual effect.

Value /Importance and Sensitivity of Receptor

Value	Criteria
High	Equivalent to MarLIN MarESA sensitivity category 'High'. The habitat or species is noted as exhibiting 'None' or 'Low' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover only over very extended timescales i.e. > 25 years or not at all (resilience is 'Very Low'); or The habitat or species is noted as exhibiting 'None' or 'Low' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover only over very extended timescales i.e. > 10 or up to 25 years (resilience is 'Low').
Medium	Equivalent to MarLIN MarESA sensitivity category 'Medium'. The habitat or species is noted as exhibiting 'None' or 'Low' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover over medium timescales i.e. > 2 or up to ten years (resilience is 'Medium'); or The habitat or species is noted as exhibiting 'None' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover over < 2 years (resilience is 'High'); or The habitat or species is noted as exhibiting 'Medium' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover over medium to very long timescales, i.e. > 2 years or up to 25 years or not at all (resilience is 'Medium', 'Low' or 'Very Low').
Low	Equivalent to MarLIN MarESA sensitivity category 'Low'. The habitat or species is noted as exhibiting 'Low' or 'Medium' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover over < 2 years (resilience is 'High'); or The habitat or species is noted as exhibiting 'High' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover over medium to very long timescales, i.e. > 2 years or up to 25 years or not at all (resilience is 'Medium', 'Low' or 'Very Low').
Negligible	Equivalent to MarLIN MarESA sensitivity category 'Not Sensitive'. The habitat or species is noted as exhibiting 'High' resistance (tolerance) to an external factor, whether that arises from natural events or human activities, and is expected to recover over short timescales, i.e. < 2 years (resilience is 'High').

Magnitude of Impact

Magnitude	Criteria
Major	The proposed development would result in a complete change to baseline conditions and status of conservation features/ ecological functionality; or The proposed development would result in a change from baseline conditions that would affect the conservation status of the site or feature.
Moderate	The site feature's conservation status would not be affected, but the impact is likely to be significant in terms of ecological objectives or populations. If, in light of full information, it cannot be clearly demonstrated that the impact will not adversely affect the conservation objectives, then the impact should be assessed as high.
Minor	Minor shift away from baseline but the impact is of limited temporal or physical extent.
Negligible	No change from baseline conditions/ observable impact predicted.

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2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

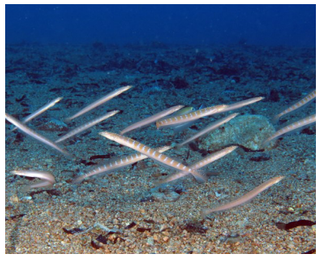
Fish and Shellfish Ecology

Definitions—what does it involve?

Fish and Shellfish Ecology—

Identifies all components of fish and shellfish ecology of relevance to Hornsea Four. This includes demersal and pelagic fish species including those which are of commercial importance. This chapter also addresses spawning and nursery grounds.





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Fish and Shellfish Ecology baseline to understand the existing situation

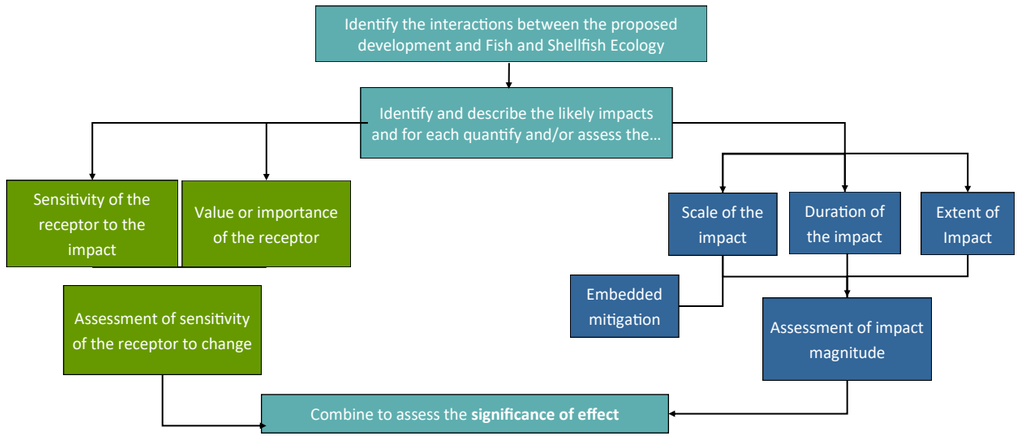
The study area encompasses two areas; the primary fish and shellfish study are and the secondary fish and shellfish study area. The primary fish and shellfish study area is defined as the area encompassing Hornsea Four which includes the Hornsea Four array area, offshore export cable corridor (ECC) and the area in the immediate vicinity of the offshore ECC landfall search area. The primary fish and shellfish study area also includes much of the wider former Hornsea Zone including a 4 km buffer to the north and south of the boundary (i.e. the zone of potential impact). A secondary fish and shellfish study area is also considered in relation to indirect impacts which may have a greater spatial footprint, such as underwater noise effects or increased suspended sediment concentrations (SSC). This secondary study area considers the wider fish and shellfish assemblages in the wider central North Sea that may be affected.

A desk-based review of literature and existing data sources was undertaken., this data came from the following sources;

- Hornsea Zone Characterisation/ Hornsea Project surveys;
- Creyke Beck Environmental Statement (Forewind, 2013);
- Fish and spawning and nursery areas in UK waters (Coull *et al.*, 1998; Ellis *et al.,* 2012)
- Technical reports for Strategic Environmental Assessment (SEA) Areas 2 and 3 (Department of Trade and Industry (DTI), 2001a; DTI,
- 2001b);
- International herring larvae survey (IHLS); and
- International bottom trawl survey (IBTS) .

Step 2

For each impact…



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Fish and Shellfish Ecology.

Assess the significance of the residual effect.

Value/Importance and Sensitivity

Value	Criteria
Very High	Nationally and internationally important receptors with high vulnerability and no ability for recovery.
High	Regionally important receptors with high vulnerability and no ability for recovery. Nationally and internationally important receptors with medium to high vulnerability and low to medium recoverability.
Medium	Locally important receptors with medium to high vulnerability and low recoverability. Regionally important receptors with low vulnerability and medium recoverability. Nationally and internationally important receptors with low vulnerability and medium to high recoverability.
Low	Receptor is not vulnerable to impacts regardless of value/ importance. Locally important receptors with low vulnerability and medium to high recoverability.

Magnitude of Impact

Magnitude	Criteria
High	The proposal would affect the conservation status of the site or feature, with loss of ecological functionality. Major shift away from baseline conditions.
Medium	The feature's conservation status would not be affected, but the impact is likely to be significant in terms of ecological objectives or populations. Fundamental shift away from baseline conditions.
Low	Minor change from the baseline condition but the impact is of limited temporal or physical extent
Negligible	No change from the baseline conditions.

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Marine Mammals

Definitions—what does it involve?

Marine Mammals -

The marine mammals chapter includes all marine mammals that may be of relevance to Hornsea Four. The marine mammals of concern include the harbour porpoise (*Phocena phocena),* white-beaked dolphin (*Lagenorhynchus albirostris*), minke whale (*Balaenoptera acutorostrata*), harbour seal, (*Phoca vitulina)* and grey seal (*Halichoerus grypus*).





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a marine mammal baseline to understand the existing situation

The study area for marine mammals has been defined at two spatial scales:

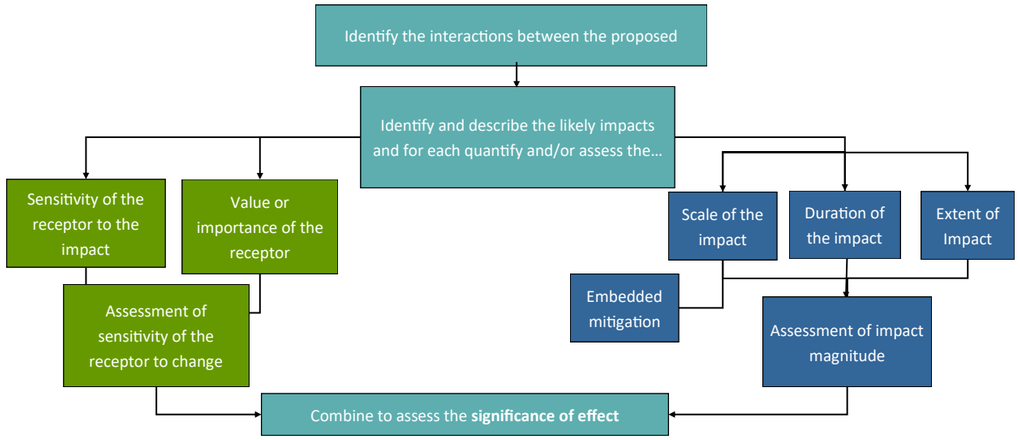
1. The Management Unit scale for species specific population units and
2. The marine mammal survey area for an indication of the local densities of each species. The marine mammal survey area encompasses the Hornsea Four array area plus 4km buffer and the offshore cable corridor and extends out to incorporate the former Hornsea Zone plus 10km buffer area.

A desk-based review of literature and existing data sources was undertaken which includes (but is not limited to) the following data sources:

- Hornsea Four digital aerial surveys and Former Hornsea Zone visual and acoustic vessel surveys;
- Density and abundance estimates from the SCANS III surveys to study the distribution and abundance of cetaceans in European Atlantic waters;
- Sea Mammal Research Unit data on harbour and grey seal August haul-out counts, grey seal pup production estimates and telemetry data;
- Estimated harbour and grey seal densities from at-sea usage maps;
- A range of analysis of nationwide sightings databases that cover multiple years and multiple data sources; and
- Data on movements of seals between UK and European seal haul-out sites.

Step 2

For each impact...



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on marine mammals.

Assess the significance of the residual effect.

Value/ Importance and Sensitivity of Receptor

Value	Criteria
Very High	No ability to adapt behaviour so that survival and reproduction rates are affected. No tolerance—will cause a change in both reproduction and survival rates. No ability for the animal to recover.
High	Limited ability to adapt behaviour so that survival and reproduction rates may be affected. Limited tolerance – may cause a change in both reproduction and survival of individuals. Limited ability for the animal to recover from the effect.
Medium	Ability to adapt behaviour so that reproduction rates may be affected but survival rates not likely to be affected. Some tolerance –unlikely to cause a change in both reproduction and survival rates. Ability for the animal to recover from the effect.
Low	Receptor is able to adapt behaviour so that survival and reproduction rates are not affected. Receptor is able to tolerate the effect without any impact on reproduction and survival rates. Receptor is able to return to previous behavioural states/activities once the impact has ceased.
Negligible	Very little or no effect on the behaviour of the Receptor.

Magnitude of Impact

Magnitude	Criteria
High	The impact would affect the behaviour and distribution of sufficient numbers of individuals, with sufficient severity, to affect the favourable conservation status and/or the long-term viability of the population at a generational scale.
Medium	Temporary changes in behaviour and/or distribution of individuals at a scale that would result in potential reductions to lifetime reproductive success to some individuals although not enough to affect the population trajectory over a generational scale. Permanent effects on individuals that may influence individual survival but not at a level that would alter population trajectory over a generational scale.
Low	Short-term and/or intermittent and temporary behavioural effects in a small proportion of the population. Reproductive rates of individuals may be impacted in the short term (over a limited number of breeding cycles). Survival and reproductive rates very unlikely to be impacted to the extent that the population trajectory would be altered.
Negligible	Very short term, recoverable effect on the behaviour and/or distribution in a very small proportion of the population. No potential for the any changes in the individual reproductive success or survival therefore no changes to the population size or trajectory.
No change	No predicted effect.

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Offshore and Intertidal Ornithology

Definitions—what does it involve?

Offshore and Intertidal Ornithology -

The offshore and intertidal ornithology chapter includes birds species that are collectively called seabirds and shorebirds.





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate an Offshore and Intertidal Ornithology baseline to understand the existing situation

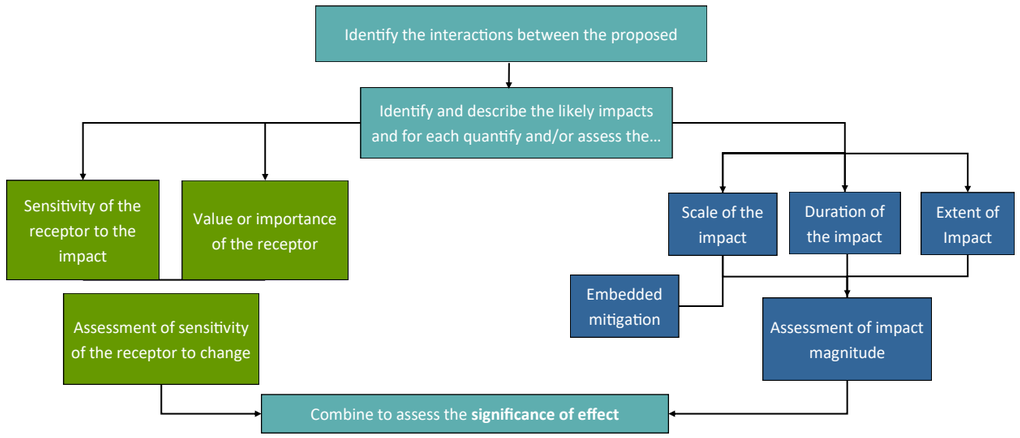
The Study Area for the offshore and intertidal ornithology receptors includes all of the sea and coasts within these areas with a particular focus on the sea within a 4 km buffer surrounding the Hornsea Four array area. The intertidal area and related assessments considers birds using the habitat mostly between mean high water springs (MHWS) and mean low water springs (MLWS), recognising that some of these birds might nest or roost on the shore above MHWS. The offshore area and related assessments considers birds using the habitat seaward of MLWS within the offshore ECC (Export Cable Corridor) out to the array area and a 4 km buffer surrounding it.

A desk-based review of literature and existing data sources was undertaken which includes (but is not limited to) the following data sources:

- Former Hornsea Zone/ Hornsea Four surveys and Environmental Statements;
- Existing monitoring reports on seabirds and offshore wind farms;
- Peer reviewed scientific papers and assessment methodologies;
- Seabird distribution, movement and population estimates; and
- Local and regional bird reports and National Atlas.

Step 2

For each impact...



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Offshore and Intertidal Ornithology.

Assess the significance of the residual effect.

Value / Importance and Sensitivity of Receptor

Value	Criteria
Very High	VORs of National or International value with very high vulnerability and no ability for recovery.
High	VORs of Regional value with high vulnerability and no ability for recovery. VORs of National or International value with high vulnerability and low recoverability. Very High VORs of National or International value with very high vulnerability and no ability for recovery.
Medium	VORs of local value with high vulnerability and no ability for recovery. VORs of Regional value with moderate to high vulnerability and low recoverability. VORs of National or International value with moderate vulnerability and medium recoverability.
Low	VORs of Local value with moderate to high vulnerability and low recoverability. VORs of Regional value with low vulnerability and medium to high recoverability. VORs of National or International value with low vulnerability and high recoverability.
Negligible	VOR is not vulnerable to the impact considered regardless of value/importance. VORs of Local value with low vulnerability and medium to high recoverability.

Magnitude of Impact

Magnitude	Criteria
High	The proposal would affect the conservation status of the VOR with loss of ecological functionality. Recovery expected to be long term (e.g. 10 years) or irreversible following cessation of activity.
Medium	The VORs conservation status would not be affected, but the impact is likely to be significant in terms of ecological objectives or populations. Recovery expected to be medium term (e.g. 5 years) following cessation of activity.
Low	Minor shift away from baseline but the impact is of limited temporal or physical extent. Recovery expected to be short-term (e.g. less than 1 year) following cessation of activity.
Negligible	Very slight change from baseline condition. Any recovery expected to be rapid following cessation of activity.
No change	No change from baseline conditions.

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33 St Mary Axe
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Marine Archaeology

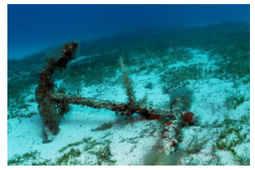
Definitions—what does it involve?

Marine Archaeology—

Identifies all marine archaeological features of relevance to Hornsea Four. The offshore marine archaeological resource can be described in three main classes of material and features:

- Submerged prehistoric landscapes;
- Archaeological remains of watercraft deposited when such vessels sank while at sea or became abandoned in an inter-tidal context which subsequently became inundated; and
- Remains of aircraft crash sites.





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Marine Archaeology baseline to understand the existing situation

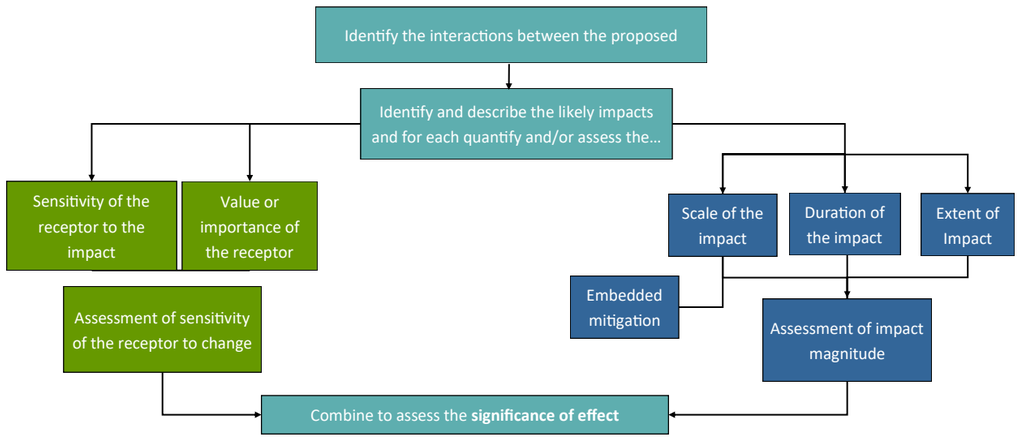
A marine archaeology study area has been established for the purposes of collating baseline data as part of the desk-based study. The marine archaeology study area encompasses the Hornsea Four array area and the offshore export cable corridor (ECC) with a 1 km buffer.

A desk-based review of literature and existing data sources was undertaken, this data came from the following sources;

- National Record of the Historic Environment (NRHE) data in relation to wrecks and paleoenvironmental evidence via Archaeology Data Service (ADS) ArchSearch;
- Records of known wrecks and obstructions held by the United Kingdom Hydrographic Office (UKHO) and available via OceanWise;
- Local historic environment records held by Hull Historic Environment Record;
- Admiralty charts and historic mapping relevant to the defined study area;
- Important research archives e.g. The North Sea Palaeolandscapes Project (Gaffney *et al*., 2007); The Humber Regional Environmental Characterisation project (Tappin *et al*., 2011); and
- Other secondary sources and grey literature e.g. unpublished technical reports and data held by Ørsted that inform the current project.

Step 2

For each impact…



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Marine Archaeology.

Assess the significance of the residual effect.

Value/ Importance and Sensitivity of Receptor

Value	Criteria
Very High	Very high importance and rarity, international scale and very limited potential for substitution. Unique in terms of period, rarity, level of documentation, group value, condition, vulnerability, diversity and / or archaeological potential.
High	High importance and rarity, national scale and limited potential for substitution. Very rare in terms of period, rarity, level of documentation, group value, condition, vulnerability, diversity and / or archaeological potential.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution. Regionally rare in terms period, rarity, level of documentation, group value, condition, vulnerability, diversity and / or archaeological potential.
Low	Low importance and rarity, local scale. Low value in terms of period, rarity, level of documentation, group value, condition, vulnerability, diversity and / or archaeological potential.
Negligible	Very low importance and rarity, local scale. Very little or no appreciable value in terms of period, rarity, level of documentation, group value, condition, vulnerability, diversity and / or archaeological potential.

Magnitude of Impact

Magnitude	Criteria
Large	Substantial or complete change of archaeological sites, resulting in significant alteration, inhibiting interpretation of characteristics, sub-features or components. Substantial or complete change of archaeological materials, resulting in significant alteration, inhibiting interpretation of characteristics, sub-features or components. Change to environment or context of archaeological materials or features, resulting in significant alteration of archaeological site, feature or materials.
Medium	Moderate changes to archaeological sites, resulting in clear alteration, inhibiting interpretation of several key characteristics, sub-features or components. Moderate changes to archaeological materials, resulting in clear alteration, inhibiting interpretation of several key characteristics, sub-features or components. Change to environment or context of archaeological materials or features, resulting in clear alteration of archaeological site, feature or materials.
Small	Slight changes to archaeological sites, resulting in slight alteration, inhibiting interpretation of few characteristics, sub-features or components. Slight changes to archaeological materials, resulting in slight alteration, inhibiting interpretation of few characteristics, sub-features or components. Change to environment or context of archaeological materials or features, resulting in slight alteration of archaeological site, feature or materials.
Very small	Very minor changes to archaeological sites, resulting in very little appreciable change, not inhibiting interpretation of characteristics, sub-features or components. Very minor changes of archaeological materials, resulting in very little appreciable change, not inhibiting interpretation of characteristics, sub-features or components. Very minor change to environment or context of archaeological materials or features, resulting in very little appreciable alteration of archaeological site, feature or materials.
Negligible / no change	Changes that are indistinguishable from natural variation, do not change archaeological sites or materials, and do not affect key characteristics, sub-features, or components or their environment or context.

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33 St Mary Axe
London, EC3A 8AA

Commercial Fisheries

Definitions—what does it involve?

Commercial Fisheries-

Identifies the commercial fisheries receptors of relevance to Hornsea Four, this include both UK and non-UK vessels such as Dutch and German vessels which fish for herring *(Clupea harengus)* and *(Ammodytes marinus*).





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Commercial Fisheries baseline to understand the existing situation

The proposed Hornsea Four array area is located within the southwest portion of the International Council for the Exploration of the Sea (ICES) Division 4b (Central North Sea) statistical area; outside the 12 NM limit in UK Exclusive Economic Zone (EEZ) waters. For the purpose of recording fisheries landings, ICES Division 4b is divided into statistical rectangles which are consistent across all Member States operating in the North Sea.

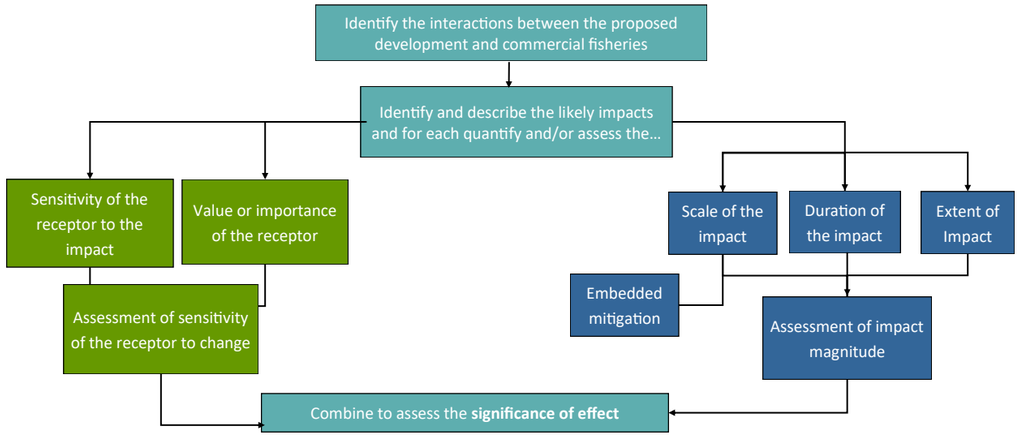
For the purposes of this scoping exercise, the Hornsea Four commercial fisheries study area comprises six ICES rectangles (ICES Rectangles 37E9 to 37F1 and 36E9 to 36F1), within which the array area (ICES rectangles 37F0, 37F1, and 36F1) and offshore Export Cable Corridor (ECC) (ICES rectangles 37E9, 37F0, 37F1, 36F1, 36F0, and 36E9) are located.

A desk-based review of literature and existing data sources was undertaken which includes (but is not limited to) the following data sources:

- Landing Statistics from 2012—2016; and
- Vessel Monitoring System (VMS) from 2012 –2016.

Step 2

For each impact...



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on commercial fisheries

Assess the significance of the residual effect.

Value/ Importance and Sensitivity of Receptor

Value	Criteria
Very High	Receptor is highly vulnerable to impacts that may arise from the project and recoverability is long term or not possible. And/or: No alternative fishing grounds are available.
High	Receptor is generally vulnerable to impacts that may arise from the project and recoverability is slow and/or costly. And/or: Low levels of alternative fishing grounds are available and/or fishing fleet has low operational range.
Medium	Receptor is somewhat vulnerable to impacts that may arise from the project and has moderate levels of recoverability. And/or: Moderate levels of alternative fishing grounds are available and/or fishing fleet has moderate operational range.
Low	Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability. And/or: High levels of alternative fishing grounds are available and/or fishing fleet has large to extensive operational range; fishing fleet is adaptive and resilient to change.
Negligible	Receptor is not vulnerable to impacts that may arise from the project and/or has high recoverability. And/or: Extensive alternative fishing grounds available and/or fishing fleet is highly adaptive and resilient to change.

Magnitude of Impact

Magnitude	Criteria
Major (Adverse)	Impact is of long-term duration (e.g. greater than 12 years duration) and/or is of extended physical extent; And: ●Impact is expected to result in one or more of the following: ●Substantial loss of target fish or shellfish biological resource (e.g. loss of substantial proportion of resource within project area); and ●Substantial loss of ability to carry on fishing activities (e.g. substantial proportion of effort within project area).
Major (Beneficial)	Impact is expected to result in one or more of the following: ●Large scale or major improvement of resource quality, measurable against biomass reference points; and ●Extensive restoration or enhancement of habitats supporting commercial fisheries resources.
Moderate (Adverse)	Impact is of medium term duration (e.g. less than 12 years) and/or is of moderate physical extent; And: Impact is expected to result in one or more of the following: ●Partial loss of target fish or shellfish biological resource (e.g. moderate loss of resource within project area); and ●Partial loss of ability to carry on fishing activities (e.g. moderate reduction of fishing effort within project area).
Moderate (Beneficial)	Impact is expected to result in one or more of the following: ●Moderate improvement of resource quality; and ●Moderate restoration or enhancement of habitats supporting commercial fisheries resources.
Minor (Adverse)	Impact is of short-term duration (e.g. less than 5 years) and/or is of limited physical extent; And: Impact is expected to result in one or more of the following: ●Minor loss of target fish or shellfish biological resource (e.g. minor loss of resource within project area); and ●Minor loss of ability to carry on fishing activities (e.g. minor reduction of fishing effort within project area).
Minor (Beneficial)	Impact is expected to result in one or more of the following: ●Minor benefit to or minor improvement of resource quality; and ●Minor restoration or enhancement of habitats supporting commercial fisheries resources.
Negligible (Adverse)	Impact is of very short-term duration (e.g. less than 2 years) and/or physical extent of impact is negligible; And: Impact is expected to result in one or more of the following: ●Slight loss of target fish or shellfish biological resource (e.g. slight loss of resource within project area); and ●Slight loss of ability to carry on fishing activities (e.g. slight loss of fishing effort within project area).
Negligible (Beneficial)	Impact is expected to result in one or more of the following: ●Very minor benefit to or very minor improvement of resource quality; and ●Very minor restoration or enhancement of habitats supporting commercial fisheries resources.
No change	No change from baseline consditions.

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2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Assessing Commercial Fisheries Impacts

Shipping and Navigation

Definitions—what does it involve?

Shipping and Navigation -

Identifies all shipping and navigational receptors which are of relevance to Hornsea Four. This includes shipping lanes, fishing vessel's recreational shipping, ferry routes and navigational aids including radar and communications equipment .





Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Shipping and Navigation baseline to understand the existing situation

The study area for this assessment extends 10 nautical miles (NM) from Hornsea Four , and two NM from the offshore export cable corridor (ECC). This study area was discussed and agreed with the Maritime and Coastguard Agency (MCA) during pre-scoping consultation.

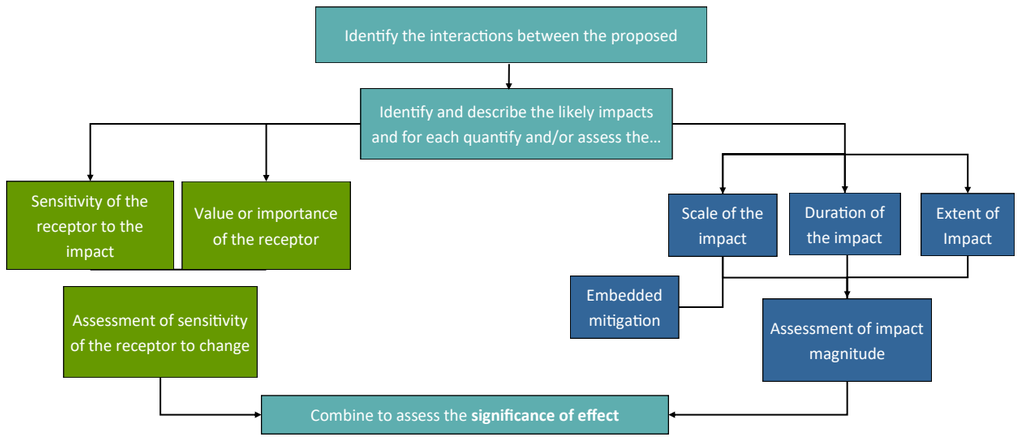
In addition, and where relevant, shipping routes across the North Sea were considered in terms of how they interact with the former Hornsea Zone.

A desk-based review of literature and existing data sources was undertaken which includes (but is not limited to) the following data sources:

- One calendar year of Automatic Identification System (AIS) ;
- Marine Management Organisation (MMO) aggregated Vessel Monitoring System (VMS) fishing data;
- Royal Yachting Association (RYA) recreational cruising routes; and
- Consultation with the Maritime and Coastguard Agency (MCA).

Step 2

For each impact...



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Shipping and Navigation.

Assess the significance of the residual effect.

Value/ Importance and Sensitivity of Receptor

Value	Criteria
Very High	Multiple fatalities, loss of vessels, major environmental pollution and significant impact to Hornsea Four.
High	Single fatality possible, significant damage to vessels, some environmental pollution and impact to Hornsea Four.
Medium	Multiple injuries possible, minor damage to vessels, minor pollution and minor impact to Hornsea Four.
Low	Minor injury, superficial damage to vessel, no pollution, superficial impact to Hornsea Four.
Negligible	Negligible impact.

Magnitude of Impact

Magnitude	Criteria
Major	Significant increase in impact as a result of Hornsea Four. Impact likely to occur several time during project life time.
Moderate	Moderate increase in impact as a result of Hornsea Four. May occur once during the lifetime of project.
Minor	Minor increase in impact as a result of Hornsea Four. Unlikely to occur during life time of project.
Negligible	Negligible increase in impact as a result of Hornsea Four.
No change	Impact is unchanged as a result of Hornsea Four.

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2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Aviation and Radar

Definitions—what does it involve?

Aviation and Radar

Identifies interactions of aviation and radar infrastructure and operation with respect to the Hornsea Four array area and offshore export cable corridor (ECC) by considering the proximity to and operation of airports, the types of radar systems providing radar coverage off the UK East Coast, helicopter and Ministry of Defence (MOD) operations.



Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate an Aviation and Radar baseline to understand the existing situation

The aviation and radar study area includes all existing aviation and radar receptors within an area that might be potentially affected by Hornsea Four. This area has been defined as the Hornsea Four array area, the offshore ECC and the following specific receptors / areas within the wider southern North Sea region:
Radars near the eastern coast of England that could potentially detect 370 metre (m) high (blade tip) Wind Turbine Generators (WTGs) within the array area;

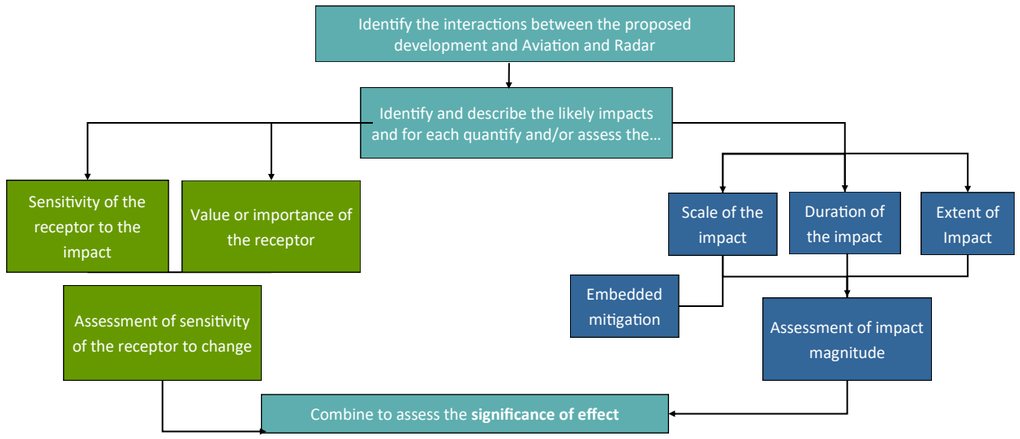
- Military Low Flying Operations;
- Offshore helicopter flight operations including Helicopter Main Routes (HMR) operating within the proximity of the array area;
- Offshore oil and gas platforms that are located within a 9 nautical mile (NM) consultation buffer that overlap with the array area; and
- Search and Rescue (SAR) flight operations .

A desk-based review of literature and existing data sources was undertaken, this data came from the following sources;

- Civil Aviation Authority Civil Aviation Publications (CAP);
- Military Aeronautical Information Publication (Mil AIP) (MOD, 2018); and
- Maritime and Coastguard Agency (MCA) Maritime Guidance Notes (MGN).

Step 2

For each impact…



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Aviation and Radar

Assess the significance of the residual effect.

Value / Importance and Sensitivity of Receptor

Value	Criteria
Very High	Receptor or the activity of the receptor, is of critical importance to the local, regional or national economy and/or the receptor or the activities of the receptor, is highly vulnerable to impacts that may arise from the project and/or recoverability is long term or not possible
High	Receptor or the activities of the receptor, is of high value to the local, regional or national economy and/or the receptor or the activities of the receptor, is generally vulnerable to impacts that may arise from the project and/or recoverability is slow and/or costly.
Medium	Receptor or the activities of the receptor, is of moderate value to the local, regional or national economy and/or the receptor or the activities of the receptor, is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high levels of recoverability
Low	Receptor or the activities of the receptor, is of low value to the local, regional or national economy and/or the receptor or the activities of the receptor, is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.
Negligible	Receptor or the activities of the receptor, is of negligible value to the local, regional or national economy and/or the receptor or the activities of the receptor, is not vulnerable to impacts that may arise from the project and/or has high recoverability.

Magnitude of Impact

Magnitude	Criteria
Major	Total loss of ability to carry on activities and/or impact is of extended physical extent and/or long-term duration (i.e. total life of project and/or frequency of repetition is continuous and/or effect is not reversible for project).
Moderate	Loss or alteration to significant portions of key components of current activity and/or physical extent of impact is moderate and/or medium-term duration (i.e. operational period) and /or frequency of repetition is medium to continuous and/or effect is not reversible for project phase.
Minor	Minor shift away from baseline, leading to a reduction in level of activity that may be undertaken and/or physical extent of impact is low and/or short to medium term duration (i.e. construction period) and /or frequency of repetition is low to continuous and/or effect is not reversible for project phase.
Negligible	Very slight change from baseline condition and/or physical extent of impact is negligible and/or short- term duration (i.e. less than two years) and/or frequency of repetition is negligible to continuous and/or effect is reversible.
No change	No change from baseline conditions.

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2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Seascape and Visual Resources

Definitions—what does it involve?

Seascape and Visual Resources -

Identified the seascape and visual receptors of relevance to Hornsea Four this includes the historic seascape character (HSC).



Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Seascape and Visual Resources baseline to understand the existing situation

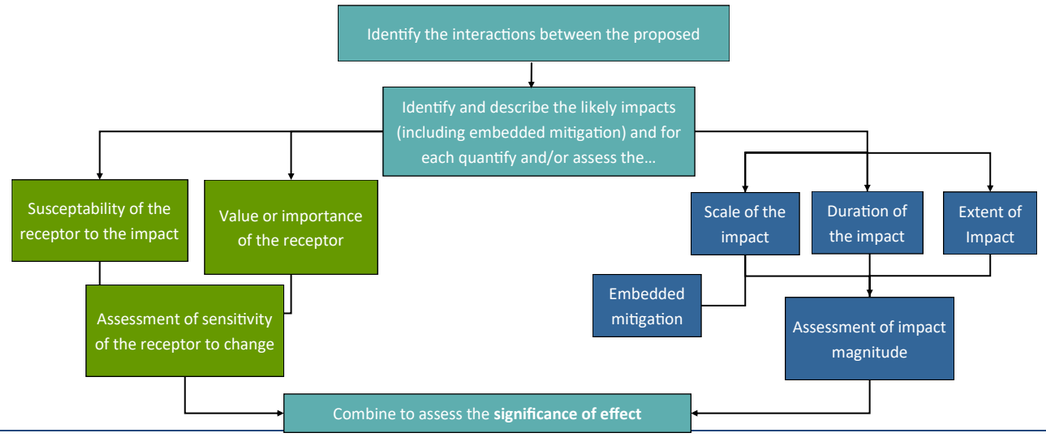
The proposed Hornsea Four array area is located in the English Channel at a distance of approximately 65 km to the east of the English coast at its closest point, which is at Flamborough Head.

A preliminary desk based review of literature and data sources to support this Scoping Report has highlighted the following data sources;

- SeaZone Hydro View 1:75,000 raster and vector mapping
- Marine Plan Areas in England. Marine Management Organisation (MMO, 2014)
- Seascape character area assessment for East Inshore and East Offshore marine plan areas (MMO, 2012);
- MMO1134 Seascape Character Assessment for the North East Inshore and Offshore marine plan areas (MMO, Sept 2018).
- Seascape characterisation around the English Coast (Marine Plan Areas 3 and 4) (Natural England, 2012);
- Historic Seascape Characterisation (HSC) data; and
- Recorded Visibility Data (Met Office, 2016) referenced from Hornsea Project Three ES.

Step 2

For each impact…



Step 3 Mitigation

Apply mitigation and assess residual effects

It is anticipated that at the assessment stage all mitigation of SVR impacts will be included in the project envelope as embedded mitigation and therefore the effects will be assessed as set out above.

Value/ Importance and Sensitivity - Seascape and Visual Receptors (SVR)

Value	Criteria
Very High	A SVR extremely sensitive to the proposed change, which would result in significant effects on the SVR.
High	A SVR particularly sensitive to the proposed change, which would result in many effects on the SVR.
Medium	A SVR capable of accepting limited proposed change with some effects on the SVR.
Low	A SVR capable of accommodating considerable proposed change with some limited effects on the SVR.
Negligible	A SVR capable of accommodating considerable proposed change without significant effects on the SVR.

Magnitude of Impact—Present day seascape resource

Magnitude	Criteria
Major	Total or very substantial loss of key elements/features/patterns of the baseline, i.e. pre-development seascape, and/or introduction of dominant elements with the attributes of the receiving seascape.
Moderate	Partial loss or a moderate alteration to one or more key elements/features/patterns of the baseline, i.e. predevelopment seascape, and/or introduction of elements that may be prominent but may not necessarily be substantially uncharacteristic with the attributes of the receiving seascape.
Minor	Minor loss or alteration to one or more key elements/features/patterns of the baseline, i.e. pre-development seascape, and/or introduction of elements that may not be uncharacteristic with the surrounding seascape
Negligible	Very minor loss or alteration to one or more key elements/features/patterns of the baseline, i.e. predevelopment seascape, and/or introduction of elements that are not uncharacteristic with the surrounding seascape approximating to a 'no-change' situation.
No change	No loss or alteration to the receiving seascape resource

Magnitude of Impact—Visual resource

Magnitude	Criteria
Major	Complete or very substantial change in view. Change dominant involving complete or very substantial obstruction of existing view or complete change in character and composition of baseline, e.g. through removal of key elements.
Moderate	Moderate change in view which may involve partial obstruction of existing view or partial change in character and composition of baseline, i.e. pre-development view, through the introduction of new elements or removal of existing elements. Change may be prominent, but will not substantially alter scale and character of the surroundings and the wider setting. Composition of the view will alter. View character may be partially changed through the introduction of features which, though uncharacteristic, may not necessarily be visually discordant
Minor	Minor change in baseline, i.e. pre-development view. Change will be distinguishable from the surroundings whilst composition and character will be similar to the pre change circumstances.
Negligible	Very slight change in baseline, i.e. pre-development view. Change barely distinguishable from the surroundings. Composition and character of view substantially unaltered
No change	No alteration to the existing view.

Magnitude of Impact—HSC Type

Magnitude	Criteria
Major	Substantial change within all or most of a defined area of an HCS, such that the perception of the HSC is fundamentally changed
Moderate	Substantial change within a large part of a defined area of an HCS, such that the perception of the HSC is changed. Insubstantial change within all or most of a defined area of an HCS, such that the perception of the HSC is changed
Minor	Substantial change within a small part of a defined area of HCS, such that the perception of the HSC could be changed. Insubstantial change within a large part of a defined area of an HCS, such that the perception of the HSC could be changed.
Negligible	Insubstantial change within a small part of a defined area of HCS, such that the perception of the HSC is unlikely to be changed.
No change	No changes to any HCS

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2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Assessing Seascape and Visual Resources Impacts

Infrastructure and Other Users

Definitions—what does it involve?

Infrastructure and Other Users—

Identifies all infrastructure and other users receptors which are of relevance to Hornsea Four. These include:

- Other offshore wind farms;
- Existing and proposed cables and pipelines;
- Carbon capture and storage and natural gas storage;
- Disposal sites;
- MOD exercise areas and dangers area;
- Aggregate extraction; and
- Oil and gas operations.



Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a Infrastructure and Other Users baseline to understand the existing situation

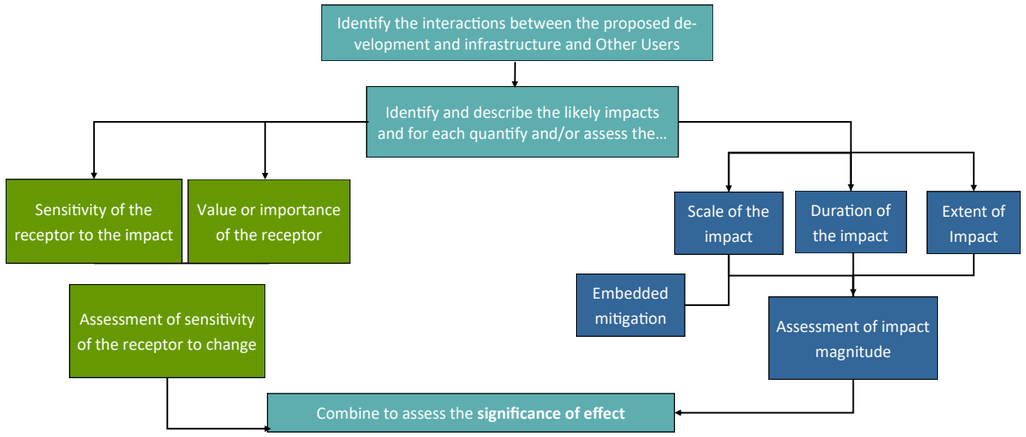
The infrastructure and other marine users study area includes all infrastructure and other marine users receptors within an area which has the potential to be affected by Hornsea Four. This includes the Hornsea Four array area and the scoping boundary for the offshore Export Corridor Cable (ECC).

A desk-based review of literature and existing data sources was undertaken which includes (but is not limited to) the following data sources:

- The Crown Estate (TCE) Charts Offshore Wind Lease Agreement Areas;
- OceanWise Marine Themes;
- Kingfish Information Service—Cable Awareness;
- TCE Aggregate Licence Area Charts;
- Business, Energy and Industrial Strategy; and
- UK Oil and Gas Data.

Step 2

For each impact...



Step 3 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse impacts of identified impacts on Infrastructure and Other Users.

Assess the significance of the residual effect.

Value/ Importance and Sensitivity of Receptor

Value	Criteria
Very High	Receptor or the activities of the receptor is of critical importance to the local, regional or national economy and/or the receptor or the activities of the receptor is highly vulnerable to impacts that may arise from the project and/or recoverability is long term or not possible.
High	Receptor or the activities of the receptor is of high value to the local, regional or national economy and/or the receptor or the activities of the receptor is generally vulnerable to impacts that may arise from the project and/or recoverability is slow and/or costly.
Medium	Receptor or the activities of the receptor is of moderate value to the local, regional or national economy and/or the receptor or the activities of the receptor is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high levels of recoverability.
Low	Receptor or the activities of the receptor is of low value to the local, regional or national economy and/or the receptor or the activities of the receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.
Negligible	Receptor or the activities of the receptor is of negligible value to the local, regional or national economy and/or the receptor or the activities of the receptor is not vulnerable to impacts that may arise from the project and/or has high recoverability.

Magnitude of Impact

Magnitude	Criteria
Major	Total loss of ability to carry on activities and/or impact is of extended physical extent and/or long term duration (i.e. total life of project) and/or frequency of repetition is continuous and/or effect is not reversible for project) (Adverse).
Moderate	Loss or alteration to significant portions of key components of current activity and/or physical extent of impact is moderate and/or medium term duration (i.e. operational period) and /or frequency of repetition is medium to continuous and/or effect is not reversible for project phase (Adverse).
Minor	Minor shift away from baseline, leading to a reduction in level of activity that may be undertaken and/or physical extent of impact is low and/or short to medium term duration (i.e. construction period) and /or frequency of repetition is low to continuous and/or effect is not reversible for project phase (Adverse).
Negligible	Very slight change from baseline condition and/or physical extent of impact is negligible and/or short term duration (i.e. less than two years) and/or frequency of repetition is negligible to continuous and/or effect is reversible (Adverse).
No change	No change from baseline conditions.

Step 1

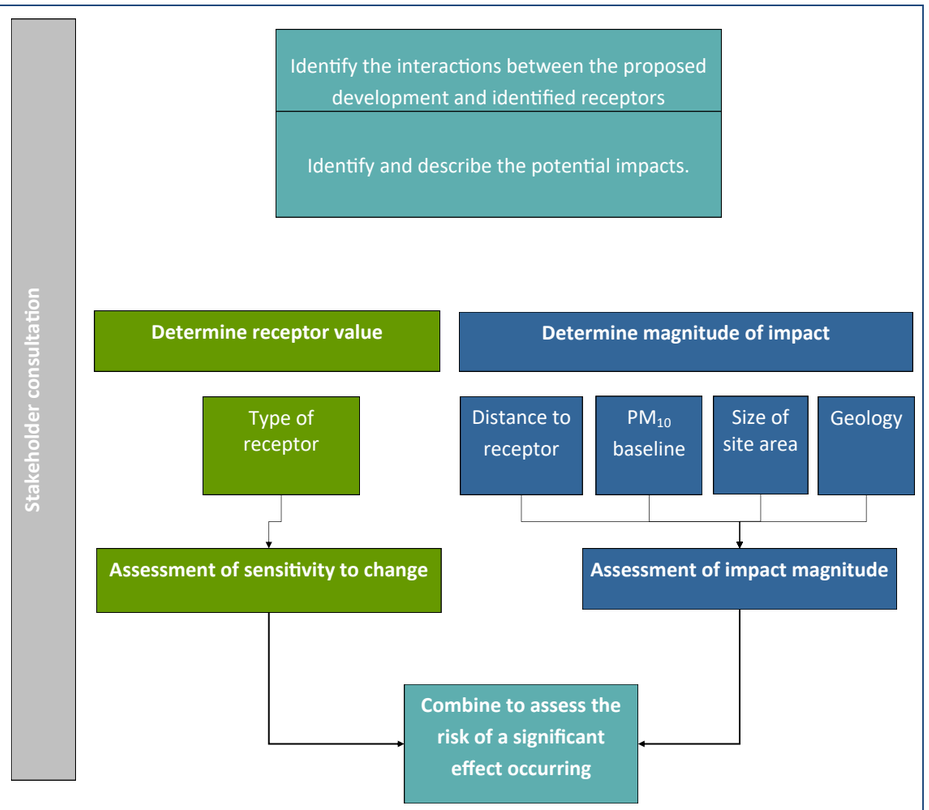
Evaluate the characteristics of the proposed development and the surrounding environment

Identify sensitive receptors (i.e. human health / nuisance).

Determine likely and potential impacts from construction, operation, maintenance and decommissioning, taking into account **embedded mitigation measures** (primary and tertiary).

Step 2

Assess the impacts



Step 3

Apply secondary mitigation and assess residual effects

Include tertiary mitigation measures in project design to mitigate dust impacts → Assess the significance of the residual effects

Receptor Sensitivity and Vulnerability

The sensitivity of the area takes account the specific sensitivities of receptors in the area.

Sensitivity	Human
Low	N/A
Medium	General population
High	Particularly vulnerable individuals, e.g. a hospital with intensive care ward

Magnitude of Change

The dust emission magnitude is based on the scale of the anticipated works and can be classified as Negligible, Small, Medium, or Large. This methodology applies to earthworks within 500 m. Professional judgement must be applied when classifying the relative importance of parameters contributing to magnitude.

Dust Emission Magnitude (Human Health / Nuisance Impacts)

Description	Magnitude	
	Undegraded Airshed	Degraded Airshed
No perceptible impact. Total site area <2,500 m², soil type with large grain size (eg. sand), total material moved <10,000 tonnes, and/or earthworks during wetter months.	Negligible	Negligible
Total site area <2,500 m², soil type with large grain size (e.g. sand), formation of bunds <4 m in height, total material moved <20,000 tonnes, and/or earthworks during wetter months.	Small	Medium
Total site area 2,500 m² – 10,000 m², moderately dusty soil type (e.g. silt), formation of bunds 4 m - 8 m in height, and/or total material moved 20,000 tonnes – 100,000 tonnes.	Medium	Large
Total site area >10,000 m², potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), formation of bunds >8 m in height, total material moved >100,000 tonnes, and/or dust generating activities for >12 months.	Large	Large

Risk Matrix

A negligible magnitude impact would have an effect that is not significant

	Sensitivity		
Magnitude	**Low**	**Medium**	**High**
Small	Not significant	Not significant	Potentially significant
Medium	Not significant	Potentially significant	Potentially significant
Large	Not significant	Potentially significant	Potentially significant

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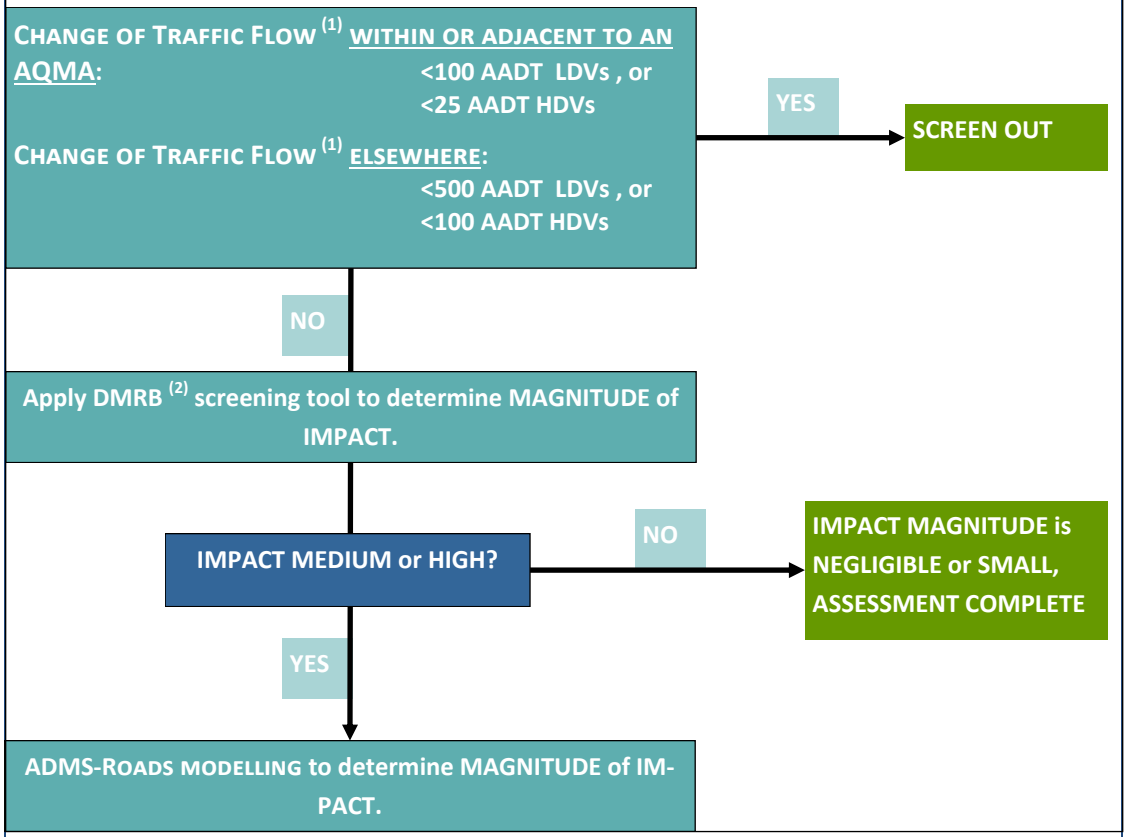
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

DETERMINE IMPACT MAGNITUDE

Define the Potential Impact Magnitude at Receptors <200 m from road using the tiered approach summarised below.

If no receptors identified within 200 m from road, impact from Road Traffic can be screened out.



HDV = Heavy Duty Vehicle, i.e. goods vehicles + buses >3.5t gross vehicle weight (1)
LDV = Light Duty Vehicle, i.e. cars and small vans <3.5t gross vehicle weight (1)
AADT = Annual Average Daily Traffic
AQMA = Air Quality Management Area

(1) IAQM: Land-Use Planning & Development Control: Planning For Air Quality, January 2017, p. 21

(2) DMRB: DESIGN MANUAL FOR ROADS AND BRIDGES, UK

MAGNITUDE OF IMPACT

The results of the DMRB screening or the ADMS-Roads modelling are compared to the UK air quality standards. To determine magnitude, the Project's Contributions (PCs) to long term average ground level pollutant concentrations are assessed in tandem with the long term average baseline concentration for a particular pollutant. The criteria used are presented below.

Long term average Concentration at receptor	Process Contribution (% Change in concentration relative to UK AQS)				
	<0.5%	0.5-1.5%	1.5-5.5%	5.5-10.5%	>10.5%
75% or less of UK AQS	Negligible	Negligible	Negligible	Small	Medium
76-94% of UK AQS	Negligible	Negligible	Small	Medium	Medium
95-102% of UK AQS	Negligible	Small	Medium	Medium	Large
103-109% of UK AQS	Negligible	Medium	Medium	Large	Large
110% or more of UK AQS	Negligible	Medium	Large	Large	Large

The Table is only designed to be used with annual mean concentrations.

The Magnitude Descriptors are for individual receptors only; the overall significance is determined using professional judgement. For example, a 'medium' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in this document (IAQM guidance then).

ERM
Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Assessing Air Quality Impacts from Road Traffic, UK Projects
(Paved Roads only)

Version 1, 31/07/2018
Prepared by: Yves Verlinden
Reviewed by: Chris Hazell-Marshall
Approved by:

Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Define the preliminary scope of the ecological impact assessment and determine the study area. Both direct and indirect impacts should be considered.

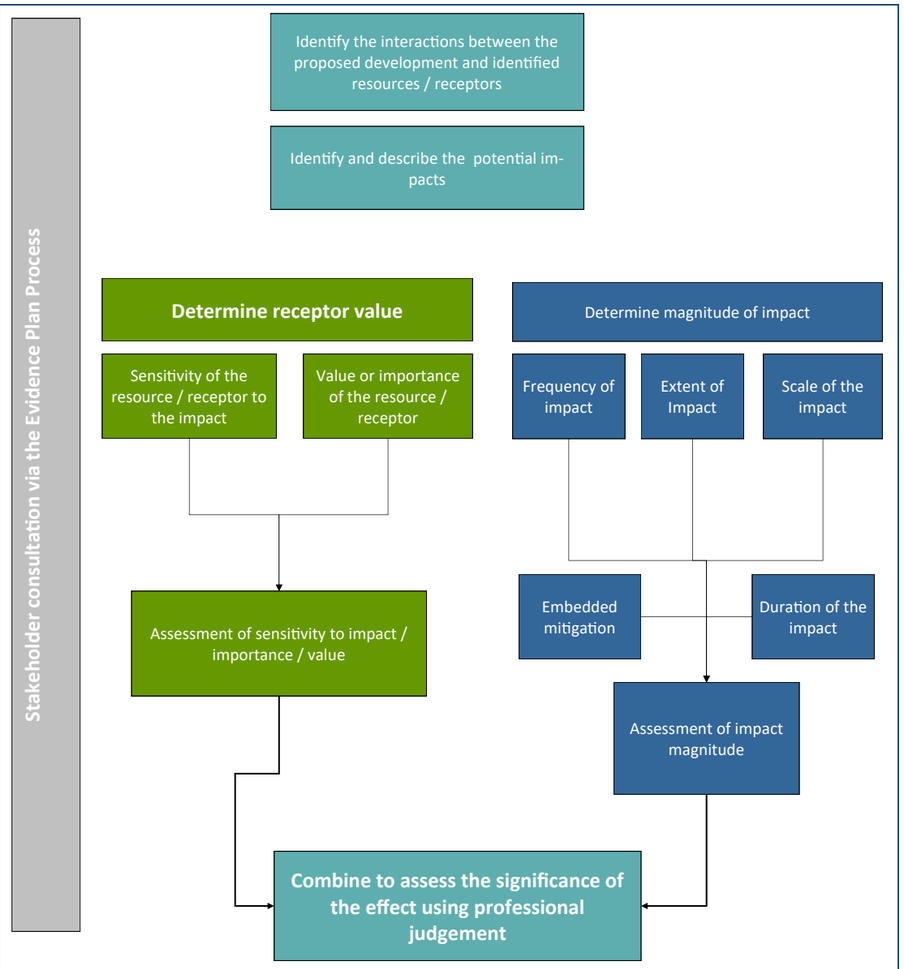
Identify ecological resources and receptors

Establish the existing baseline conditions with particular reference to distribution of habitats and species, their uniqueness in the affected area, and their value / importance

Determine likely and potential impacts from construction, operation, maintenance and decommissioning, taking into account **embedded mitigation measures** (primary and tertiary).

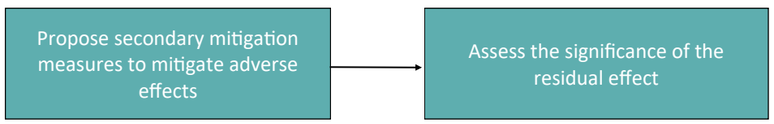
Step 2

Assess the impacts



Step 3

Apply secondary mitigation and assess residual effects



Sensitivity

Sensitivity is not an inherent characteristic of a receptor or resource. Receptor or resource sensitivity is the degree to which it is tolerant of, adaptable to and able to recover from a change in its environment. Therefore in addition to considering the importance/quality/value of the affected receptor or resource, its response (or sensitivity) to a particular impact is also considered. This is typically informed by literature review and the evidence base.

Ranking	Tolerance	Adaptability	Recoverability / Reversibility
High	Receptor unable to tolerate effect resulting in permanent change in its abundance or quality.	Receptor unable to avoid impact.	Receptor unable to recover resulting in permanent or long term change (e.g. >10 years).
Medium	Receptor has some ability to tolerate this effect but a detectable change (e.g. a change in distribution) will occur.	Receptor has some ability to avoid the most negative consequences of the impact or can partially adapt to it (e.g. by moving to other suitable areas).	Receptor recovers to an acceptable status over the short term to medium term (e.g. 1-10 years).
Low	Receptor unaffected affected.	Receptor can completely avoid the impact or adapt to it with no detectable changes.	Receptor recovers fully within the short term e.g. 1 year.

Value / Importance

Ranking	Habitats
Negligible	A feature of importance at local level. Commonplace feature of little or no habitat/historical significance. Loss of such a feature would not be seen as detrimental to the ecology of the area.
Low	A feature of importance at district level. A feature (e.g. habitat or population) that is of nature conservation value in a local context only, with insufficient value to merit a formal nature conservation designation.
Medium	A feature (e.g. habitat or population), which is either unique or sufficiently unusual to be considered as being of nature conservation value from a county to regional level. Habitats or species that form part of the cited interest of an LNR, or some local-level designated sites, such as a LWS, also referred to as a non-statutory Site of Importance for Nature Conservation or the equivalent, e.g. Ancient Woodland. Presence of habitats or species listed under Natural Environment and Rural Communities (2006) Schedule 41 LBAP habitats or species, where the action plan states that all areas of representative habitat or individuals of the species should be protected.
High	Habitats or species that form part of the cited interest within a nationally designated site, such as an SSSI or a NNR. A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in a national context for which the site could potentially be designated as a SSSI. Species that are protected under the Wildlife and Countryside Act 1981 (as amended) or Conservation of Habitats and Species Regulations (2017). Presence of habitats or where the action plan states that all areas of representative habitat or individuals of the species should be protected.
Very High	Habitats or species that form part of the cited interest within an internationally protected site, such as those designated under the Conservation of Habitats and Species Regulations (e.g. SPAs) or other international convention (e.g. Ramsar site). A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in an international/national context, such that the site is likely to be designated as a site of European importance (e.g. SAC or SPA).

Magnitude of Impact

Ranking	Habitat	Environmental factors e.g. presence, ambient air quality, noise
Negligible	Immeasurable, undetectable or within the range of normal natural variation change to the extent and condition of a habitat.	Change is within the normal range of natural variation.
Small	Minimal disturbance and/or loss of habitat, such that there is no loss of viability or function of the habitat.	Slight change expected over a limited area and returning to background levels within a few metres or tens of metres. No exceedances of benchmark limits. A temporary and localised physical change / source of disturbance.
Medium	Localised disturbance and/or loss of a habitat that does not threaten the long term viability or function of the habitat	Temporary or localised change and/or occasional exceedance of benchmark limits. A physical change in the medium term over a relatively large area.
Large	Widespread and/or permeant disturbance or loss of a habitat, threatening the long term viability or function of the habitat.	Change over a large area that lasts over the medium to long term, likely to cause secondary effects on ecology and/or routine exceedance of benchmark limits. A long term physical change that affects a large area or introduces a permanent physical barrier

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2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Define the preliminary scope of assessment and determine study area

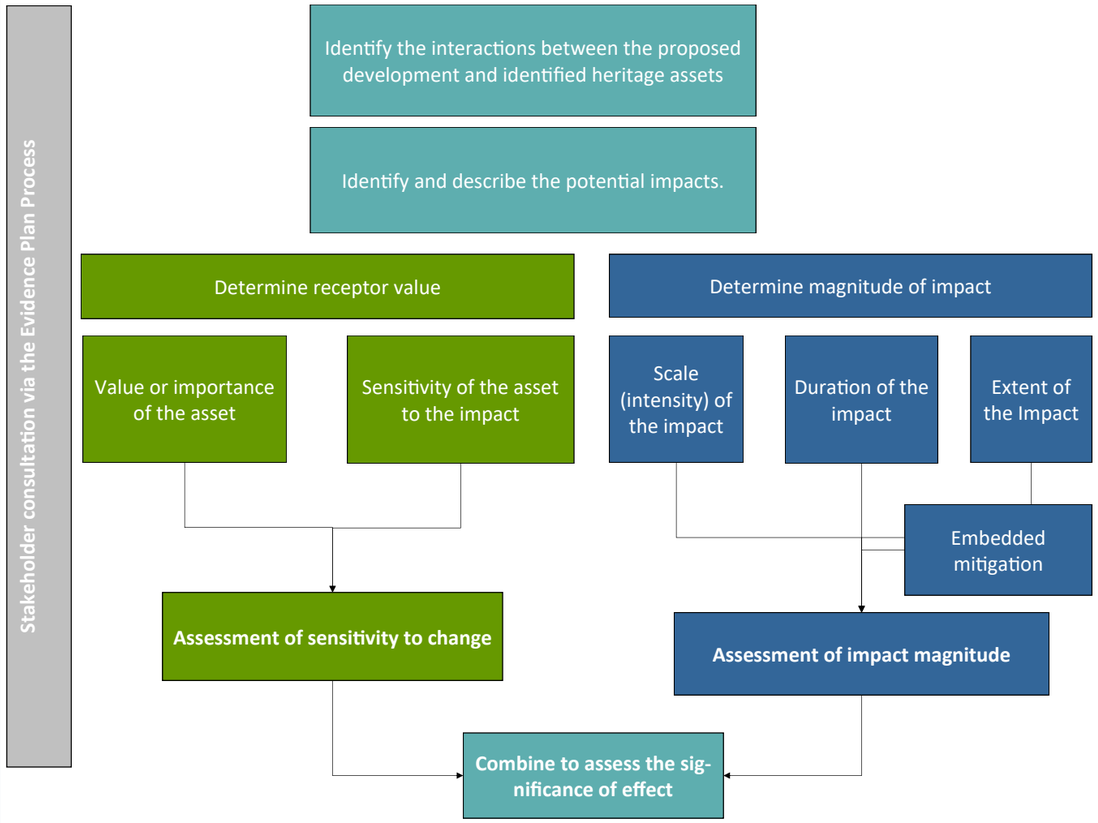
Establish existing baseline conditions through:

- Review of potential presence of known/likely assets.
- Identification of sources of existing information. Taking account of previous research.
- Assess techniques likely to be required to identify the presence of heritage assets and assess significance.
- Additional data collection through: site reconnaissance, non-intrusive survey, intrusive survey, and stakeholder consultation.

Determine likely and potential impacts from construction, operation, maintenance and decommissioning, taking into account **embedded mitigation measures** (primary and tertiary).

Step 2

Assess the impacts



Step 3

Apply secondary mitigation and assess residual effects

Propose secondary mitigation measures to mitigate adverse impacts of identified impacts on the historic environment.

Assess the significance of the residual effect. **For heritage specific matrix to assess the level of effect on heritage assets, please refer table included in the Historic Environment annex.**

Magnitude of Impact

Magnitude	Criteria
Large	Change to most or all key archaeological materials, such that the resource is totally altered. Change to key historic building elements, such that the resource is totally altered. Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit Comprehensive changes to setting .
Medium	Changes to many key archaeological materials, such that the resource is clearly modified Change to many key historic building elements, such that the resource is significantly modified. Changes to some key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character Considerable changes to setting that affect the character of the asset.
Small	Changes to key archaeological materials, such that the asset is slightly altered Change to key historic building elements, such that the asset is slightly different Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality, slight changes to use or access; resulting in limited changes to historic landscape character. Slight changes to setting.
Very Small	Very minor changes to archaeological materials or setting Slight changes to historic buildings elements or setting that hardly affect it Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality, very slight changes to use or access; resulting in a very small change to historic landscape character.
Negligible /no change	Changes that are indistinguishable from those caused by natural processes. No change to elements, parcels or components; no visual or audible changes; no changes arising from amenity or community factors

Value (significance of asset)

Value	Criteria
Very High	Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled Monuments, Grade I and II* Listed Buildings Grade II listed Buildings as appropriate Conservation areas as appropriate Non-designated assets of schedulable quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Grade II Listed Buildings as appropriate Conservation areas as appropriate Designated or non-designated assets that contribute to regional research objectives
Low	Designated and non-designated assets of local importance Locally listed buildings Robust non-designated historic landscapes
Negligible	Assets with very little or no surviving archaeological interest

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2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Assessing Historic Environment Impacts

Method and Approach for Historic Environment Impact Assessment

Assessment will consider potential impacts and effects on non-designated and designated heritage assets, comprising direct physical impacts on buried archaeological remains and potential changes to the setting of sensitive heritage assets. Assessment will be informed by a combination of desk-based study and field-based surveys (sections 1.1.3.2 and 1.1.3.3), with consultation to be held with relevant statutory and non-statutory organisations, as necessary, throughout the process.

Assessment will define and refine appropriate study areas in order to consider:

- the wider historical and archaeological context of the Hornsea Four project area;
- direct impacts on heritage assets within the construction corridor;
- indirect impacts on non-designated and designated heritage assets within a 500 m study area extending in all directions from the boundary of the construction corridor; and
- indirect impacts on designated assets within a 2.5 km study area extending in all directions from the boundary of the construction corridor.

The significance of effects will be determined using impact assessment methods and criteria outlined in the Design Manual for Roads and Bridges (DMRB) HA 208/07 (Highways Agency et al., 2007), supported by professional judgement and:

- Code of Conduct, Chartered Institute for Archaeologists, (CIfA, 2014a);
- Conservation Principles: Policies and Guidance for the Sustainable Management of the Historic Environment, (Historic England, Consultation Draft, November 2018);
- Historic Environment Good Practice Advice in Planning Note 3 (second edition): The Setting of Heritage Assets (Historic England, 2017);
- Standard and Guidance for Historic Environment Desk-Based Assessment, (CIfA, 2014b);
- Yorkshire Archaeological Research Framework: resource assessment (University of York, 2005); and
- Yorkshire Archaeological Research Framework: research agenda (University of York, 2007).

DMRB, while designed primarily for linear transport schemes, is provides useful guidance in regard to Hornsea Four as it is nationally recognised, deals with linear schemes and will be supplemented and enhanced through the use of the publications noted in 1.1.7.3 and by professional judgement.

Assessment will take into account the magnitude (intensity, duration, extent) of the impact and the sensitivity of identified heritage assets to specific, identified impacts. This will include an assessment of the value (significance) of identified heritage assets, including the contribution made to their value by setting. Potential significant effects will be described and the assessment will include consideration of potential cumulative effects as appropriate.

1.1.1 Assessment of value (significance)

The National Planning Policy Framework (NPPF, 2018) defines the significance of a heritage asset as the 'value' of that asset to this and future generations as a result of its heritage interest and suggests that heritage interest may be archaeological, architectural, artistic or historic. 'Setting' is defined in the NPPF as the surroundings in

which a heritage asset is experienced and the extent to which this may change over time (MHCLG 2018, Annex 2). Setting is recognised to contribute to the value of heritage assets. Assessment of the contribution of setting to the value of heritage assets will be undertaken in accordance with the guidance provided in Historic Environment Good Practice Advice in Planning Note 3 (second edition): The Setting of Heritage Assets (Historic England 2017).

For the purposes of assessment the historic environment will be considered under the sub-topics of 'archaeological remains', 'built environment' and 'historic landscape'. For all three sub-topics, an assessment of the value of each heritage asset was undertaken on a five-point scale of very high, high, medium, low and negligible, based on professional judgment and guided by the criteria provided in DMRB and the Historic England Conservation Principles (Historic England 2017). Reference will also be made to priorities identified in the archaeological research framework for Yorkshire (University of York 2005, 2007). Criteria to assess the value of heritage assets are presented in **Table C1**.

Table C1 Criteria to assess the value of archaeological remains, built heritage and the historic landscape

Value	Criteria
Archaeological remains	
Very High	World Heritage Sites (including nominated sites) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled Ancient Monuments (including proposed sites) Non-designated assets of schedulable quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Designated or non-designated assets that contribute to regional research objectives
Low	Designated and non-designated assets of local importance Assets compromised by poor preservation and / or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives
Negligible	Assets with very little or no surviving archaeological interest
Built Heritage	
Very High	Structures inscribed as of universal importance as World Heritage Sites Other buildings of recognised international importance

Value	Criteria
High	Scheduled Ancient Monuments with standing remains Grade I and Grade II* Listed Buildings Grade II Listed Buildings (as appropriate) Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the category Conservation Areas (as appropriate) Non-designated structures of clear national importance
Medium	Grade II Listed Buildings (as appropriate) Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations Conservation Areas (as appropriate) Historic Townscape or built-up areas with important historic integrity in their buildings, or built settings (for example including street furniture and other structures)
Low	Locally Listed buildings as recorded on a local authority list Historic (unlisted) buildings of modest quality in their fabric or historical association Historic Townscape or built-up areas of limited historic integrity in their buildings, or built settings (for example including street furniture and other structures)
Historic Landscape	
Very High	World Heritage Sites inscribed for their historic landscape qualities Historic landscapes of international value, whether designated or not Extremely well preserved historic landscapes with exceptional coherence, time-depth, or other critical factors
High	Designated historic landscapes of outstanding interest Non-designated landscapes of outstanding interest Non-designated landscapes of high quality and importance, and of demonstrable national value Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factors
Medium	Designated special historic landscapes Non-designated historic landscapes that would justify special historic landscape designation, landscapes of regional value Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factors

Value	Criteria
Low	Robust non-designated historic landscapes Historic landscapes with importance to local interest groups Historic landscapes whose value is limited by poor preservation and / or poor survival of contextual associations

1.1.2 Assessment of Magnitude of Impact

Magnitude of impact is the degree of change that would be experienced by an asset and its setting if the proposed scheme was completed, as compared with a 'do nothing' situation. Magnitude of impact will be assessed without reference to the value of each asset, and may include physical impacts on the asset or changes to its setting or amenity value.

The assessment of magnitude will be undertaken using professional judgement guided by the criteria presented in the Design Manual for Roads and Bridges (Highways Agency et al, 2007). Criteria for defining magnitude of impact are presented in **Table C2**. Unless otherwise stated, all impacts will be considered to be adverse.

Table C2 Criteria to assess the magnitude of impact on archaeological remains, built heritage and the historic landscape

Magnitude	Criteria
Large	Change to most or all key archaeological materials, such that the resource is totally altered Change to key historic building elements, such that the resource is totally altered Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit Comprehensive changes to setting
Medium	Changes to many key archaeological materials, such that the resource is clearly modified Change to many key historic building elements, such that the resource is significantly modified Changes to some key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character Considerable changes to setting that affect the character of the asset

Magnitude	Criteria
Small	Changes to key archaeological materials, such that the asset is slightly altered Change to key historic building elements, such that the asset is slightly different Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality, slight changes to use or access; resulting in limited changes to historic landscape character Slight changes to setting
Very small	Very minor changes to archaeological materials or setting Slight changes to historic buildings elements or setting that hardly affect it Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality, very slight changes to use or access; resulting in a very small change to historic landscape character
No Change	No change to elements, parcels or components; no visual or audible changes; no changes arising from amenity or community factors

1.1.3 Assessment of Level of Effect

For all three sub-topics the level of effect will be determined as a combination of the value of the asset and the magnitude of impact. This will be achieved using professional judgment informed by the matrix presented in **Table A1**. Five levels of effect are defined; neutral, slight, moderate, large and very large. Unless otherwise stated all effects are adverse.

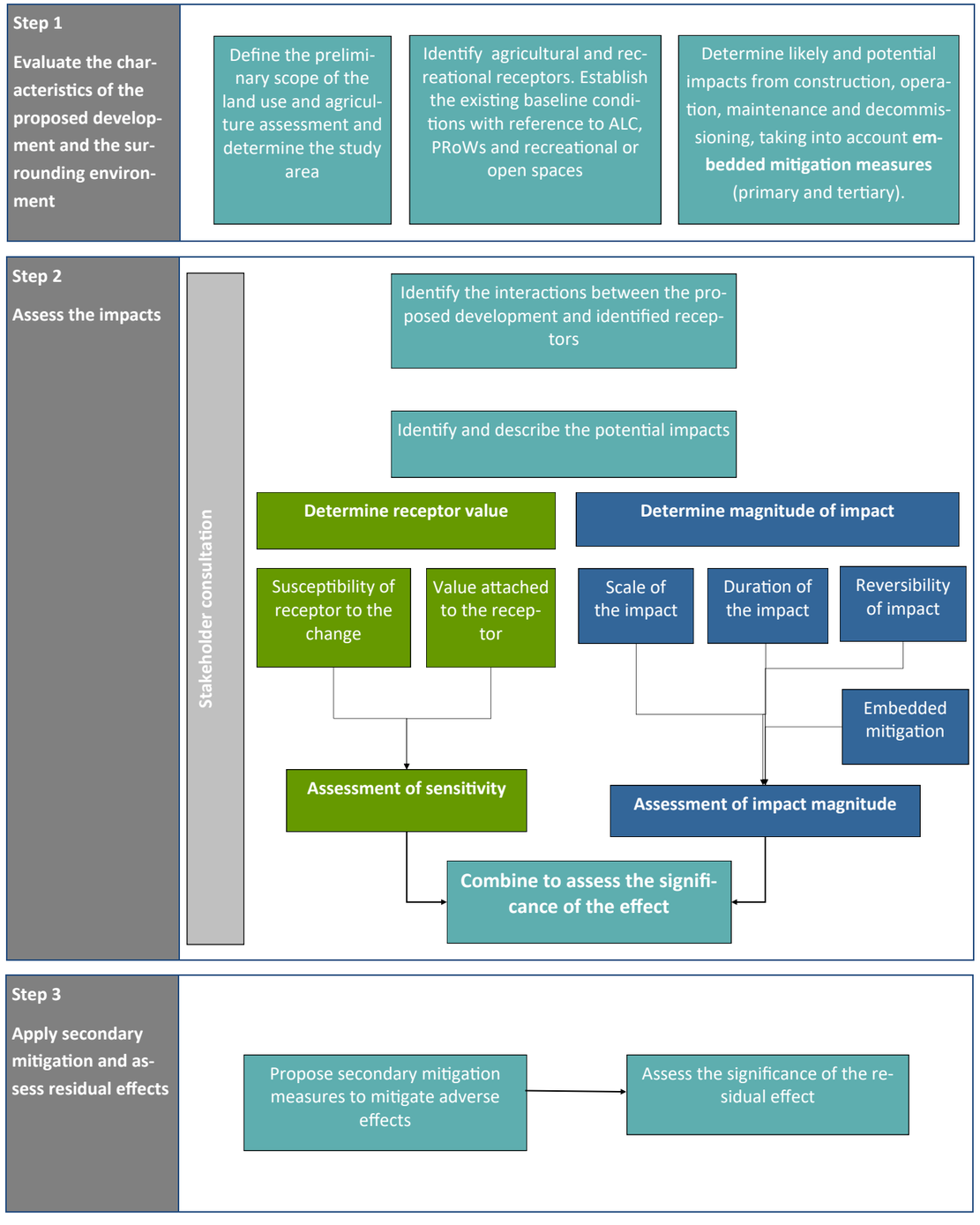
Table A1 Matrix to assess the level of effect on heritage assets

Value / Magnitude	Very High	High	Medium	Low	Negligible
Major	Very Large	Large / Very Large	Moderate / Large	Slight / Moderate	Slight
Moderate	Large / Very Large	Moderate / Large	Moderate	Slight	Neutral / Slight
Minor	Moderate / Large	Moderate / Slight	Slight	Neutral / Slight	Neutral / Slight
Negligible	Slight	Slight	Neutral / Slight	Neutral / Slight	Neutral
No change	Neutral	Neutral	Neutral	Neutral	Neutral

1.1.4 Determination of Significance

For an impact to be considered to result in a significant effect, it must, in the professional judgement of the assessor, have a residual level of effect of medium or greater and have met at least one of the following criteria:

- after mitigation, the impact could result in substantial harm (EN-1, 5.8.14; Department of Energy and Climate Change, 2011) to, or loss of, designated assets;
- it is likely that the consenting authority will reasonably consider applying a planning condition, requirement or legal agreement to the consent to require specific mitigation to reduce or overcome the effect;
- it threatens or enhances the viability, integrity, enjoyment or understanding of a heritage asset or group of heritage assets; and
- it is likely to be material to the ultimate decision about whether or not the consent application should be approved.



Receptor Sensitivity

There are no standard criteria for assessing environmental effects on land use and agriculture . Therefore, the criteria for determining significance of effects has been based on that as set out within the relevant DMRB methodologies. Interim Advice Note 125/15 of the DMRB explains that assessment should consist of an amalgamation of DMRB, Volume 11, Section 3, Part 6: Land Use and Section 3, Part 8: Pedestrians, Cyclists, Equestrians and Community Effects.

Sensitivity	Agricultural receptors	Recreational receptors
High	Presence of “best and most versatile land” (Grades 1, 2, 3a) Conventionally farmed intensive arable cropping or intensive livestock systems (eg dairy cattle).	High importance and rarity, national scale and very limited potential for substitution.
Medium	Presence of land of moderate quality (Grade 3b) Conventionally farmed mixed cropping and livestock systems of moderate intensity.	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Presence of land of poor quality (Grade 4) Conventionally farmed extensive livestock systems or agricultural land in non-agricultural use.	Low or medium importance and rarity, local scale.
Negligible	Presence of land of very poor quality (Grade 5) restricted to permanent pasture rough grazing and/or forage crops.	Very low importance and rarity, local scale.

Magnitude of Change

Magnitude of change	Agricultural receptors	Recreational receptors
Major	Loss of more than 50 ha of the “best and most versatile” agricultural land . High degree of disruption to cultivation patterns and with high risk of change in land use.	Loss of resource and/or quality and integrity of receptor, severe damage to key characteristics, features or elements.
Moderate	Loss of more than 20 ha of the “best and most versatile” agricultural land . Moderate degree of disruption to cultivation patterns with moderate risk of change in land use.	Loss of resource, but not affecting integrity, partial loss of /damage to key characteristics, features or elements.
Minor	Loss of 5 – 20 ha of the “best and most versatile” agricultural land. Minimal degree of disruption to cultivation patterns and low risk of change in land use.	Some measurable change in attributes, quality or vulnerability, minor loss of or alteration to one (possibly more) key characteristics, features or elements.
Negligible	Loss of less than 5 ha of the “best and most versatile” agricultural land. Minimal or no disruption to cultivation patterns and very low risk of change in land use.	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
No Change	No effects on agricultural land.	No loss or alteration of characteristics, features or elements, no observable impact in either direction.

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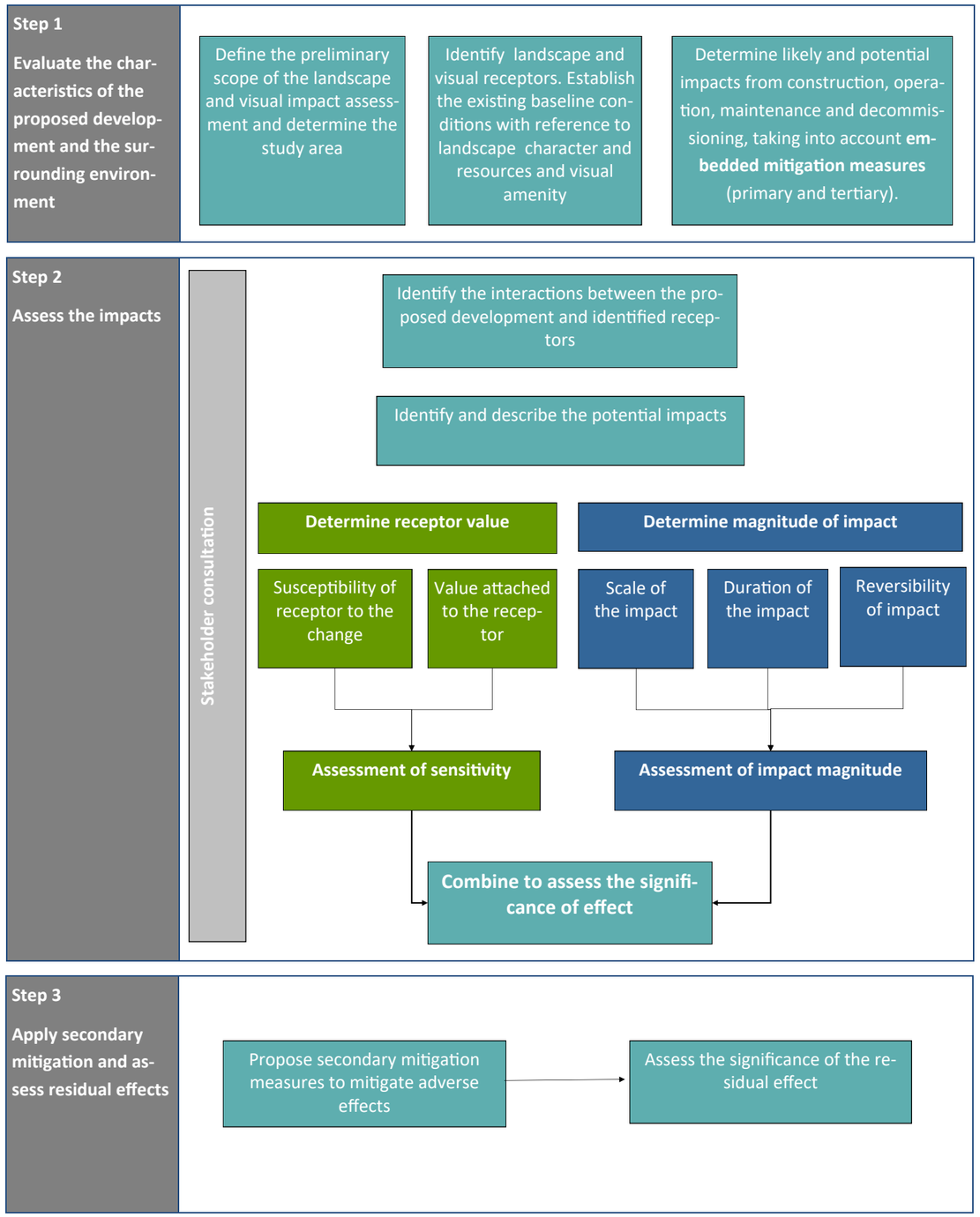
33 St Mary Axe
London, EC3A 8AA

Assessing Land Use and Agriculture Impacts



Receptor Sensitivity

Judgement based on the extent to which the receptor can accept change of a particular type and scale without adverse effects on its character (susceptibility), and the value attached to it. Viewer sensitivity depends on a number of factors including: context of the viewpoint, viewer occupation, viewing opportunities, number of people affected, and extent to which the viewers are affected by changes in their view, together with the quality of the existing view.

Sensitivity	Landscape	Visual
Low	A moderately valued landscape, perhaps a locally important landscape, or where its character, land use, pattern and scale may have the capacity to accommodate a degree of the type of change envisaged.	Small numbers of recreational viewers with interest in their surroundings. Viewers with a passing interest not specifically focussed on the landscape e.g. workers, commuters. The quality of the existing view, as likely to be perceived by the viewer, is considered to be low.
Medium	A landscape protected by a structure plan or national policy designation and/ or widely acknowledged for its quality and value; a landscape with distinctive character and low capacity to accommodate the type of change envisaged.	Small numbers of residents or moderate numbers of recreational viewers, with an interest in their environment. Larger numbers of recreational road users. The quality of the existing view, as likely to be perceived by the viewer, is considered to be medium.
High	A landscape protected by a regional (structure plan) or national designation and/ or widely acknowledged for its quality and value; a landscape with distinctive character and low capacity to accommodate the type of change envisaged.	Larger numbers of viewers and/or those with proprietary interest and prolonged viewing opportunities such as residents and users of attractive and well-used recreational facilities. The quality of the existing view, as likely to be perceived by the viewer, is considered to be high.

Magnitude of Impact

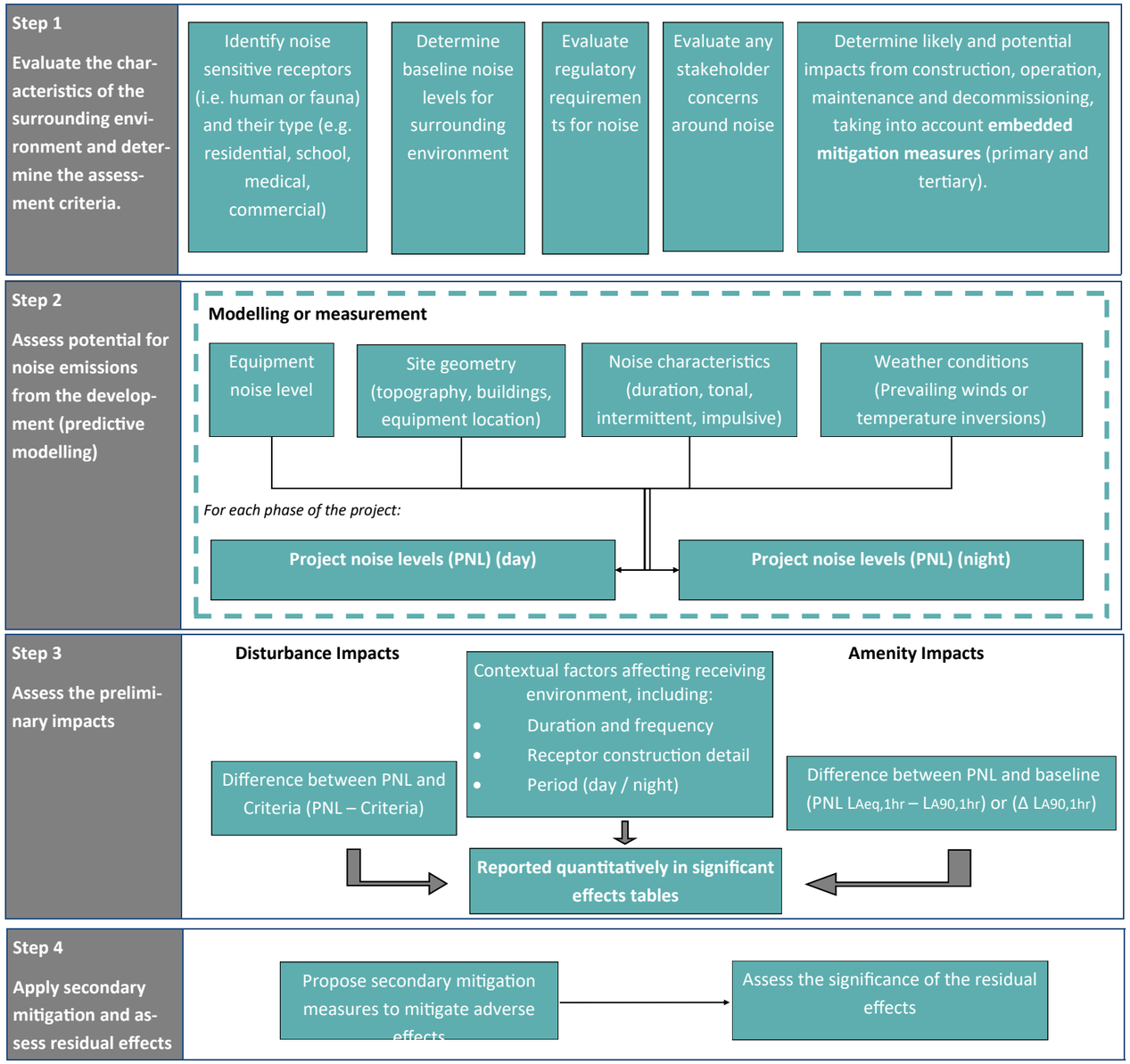
Judgement based on the nature, scale, extent, duration and reversibility of the change that is envisaged in the landscape and the overall impact on a particular view.

Magnitude of change	Landscape	Visual
Negligible	An imperceptible, barely or rarely perceptible change in landscape features and character, and/or not altering the special or key qualities of designated areas.	A change which is barely visible, at very long distances, or visible for a very short duration, perhaps at an oblique angle, or which blends with the existing view.
Small	A small change in landscape features and character over a wide area or a moderate change over a more restricted area, and/or barely altering the special or key qualities of	Minor changes in views, at long distances, or visible for a short duration, perhaps at an oblique angle, or which blends to an extent with the existing view.
Medium	A moderate change in landscape features and character, frequent or continuous, and over a wide area, or a clearly evident change either over a restricted area, and/or with some alteration to the special or key qualities of desig-	Clearly perceptible changes in views at intermediate distances, resulting in either a distinct new element in a significant part of the view, or a more wide ranging, less concentrated change across a wider area.
Large	A clearly evident and frequent /continuous change in landscape features and characteristic affecting an extensive area, or the characteristics, and/or notable and widespread alteration to the special or key qualities of	Major changes in view at close distances, affecting a substantial part of the view, continuously visible for a long duration, or obstructing a substantial part or important elements of the view.

Overview

When assessing effects from noise, impact significance is not determined in the same way that it is for most other technical disciplines, i.e. using a matrix of impact magnitude and receptor sensitivity. Consideration of receptor sensitivity is instead made at the start of the assessment, and impacts are only assessed where sensitive receptors are identified. Receptor sensitivity is represented by impact criteria determined by reference to appropriate standards or guidelines. Impact significance is determined by comparing the criteria with project noise emissions and considering the context of the receiving environment. The process followed to assess noise effects is presented below.

The approach to the noise and vibration assessment follows the methods and guidance set out in BS 5228-1 (British Standards Institution, 2014), BS 5228-2 (British Standards Institution, 2014), BS 4142 (British Standards Institution, 2014) and Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7 (Highways England, 2011).



BS 5228 provides guidance on construction plant noise and vibration levels and on the threshold of significant effects on dwellings.

DMRB provides guidance on noise effects from changes in traffic flows.

BS 4142: Methods for Rating and Assessing Industrial and Commercial Sound

The guidance used for the assessment of sound of an industrial and/or commercial nature is *BS 4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound, British Standards Institute*. The standard is applicable to investigating complaints; assessing sound from proposed, new, modified or additional sources of sound and for assessing sound at proposed new dwellings or premises used for residential purposes.

The methods described in BS 4142 use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling used for residential purposes. The principal terms used in BS 4142 are broadly defined as follows:

- **Ambient Sound** – the overall sound level from all sources.
- **Specific Sound Level**, Ls = $L_{Aeq,Tr}$ – the noise source under consideration.
- **Rating Level**, $L_{Ar,Tr}$ – Specific noise corrected to allow for certain distinctive acoustic features.
- **Residual Sound Level**, Lr = $L_{Aeq,T}$ - the noise remaining when the specific noise is sufficiently suppressed so as not to contribute to the ambient noise level.
- **Background Sound Level**, $L_{A90,T}$ – the measured L_{90} level of the residual noise.

The method requires the measurement or prediction of equipment or plant noise (Specific Sound Level) plus a correction for its acoustic character. A comparison is then made between the Rating Level and the Background Sound Level in consideration of the following overall guiding assessment values (taken from BS 4142), to provide an understanding of the potential for, and significance of effect(s):

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, it is less likely that the specific sound source will have an adverse impact or a significant adverse impact.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

The Rating Level of the source is the A-weighted L_{eq} taking into consideration the following characteristics of the sound source; tonality, impulsiveness; intermittency, time of occurrence, duration of event, and any other characteristics of the sound source that are likely to be distinctive in the environment.

BS4142 requires an *initial estimate* of the Specific Sound to be carried out which may later be modified by further consideration of the context. A series of examples are given in which the initial numerical estimate is interpreted for a given context to arrive at the assessment of significance. The following context factors need to be considered:

- the absolute level of sound where background sound levels and rating levels are low;
- where residual sound levels are very high and the residual sound might itself might result in noise impacts;
- the character and level of the residual sound compared to the character and level of the specific sound;
- evidence on likely human response to sound including references given in BS 4142; and
- the sensitivity of the receptor including façade insulation, acoustic ventilation or screening which will secure good acoustic conditions and reduce receptor sensitivity.

BS 4142 makes reference to BS 8233 for consideration of absolute (or benchmark) standards for noise which, as indicated in the examples, it recommends for the assessment of impacts when background noise levels are low.

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33 St Mary Axe
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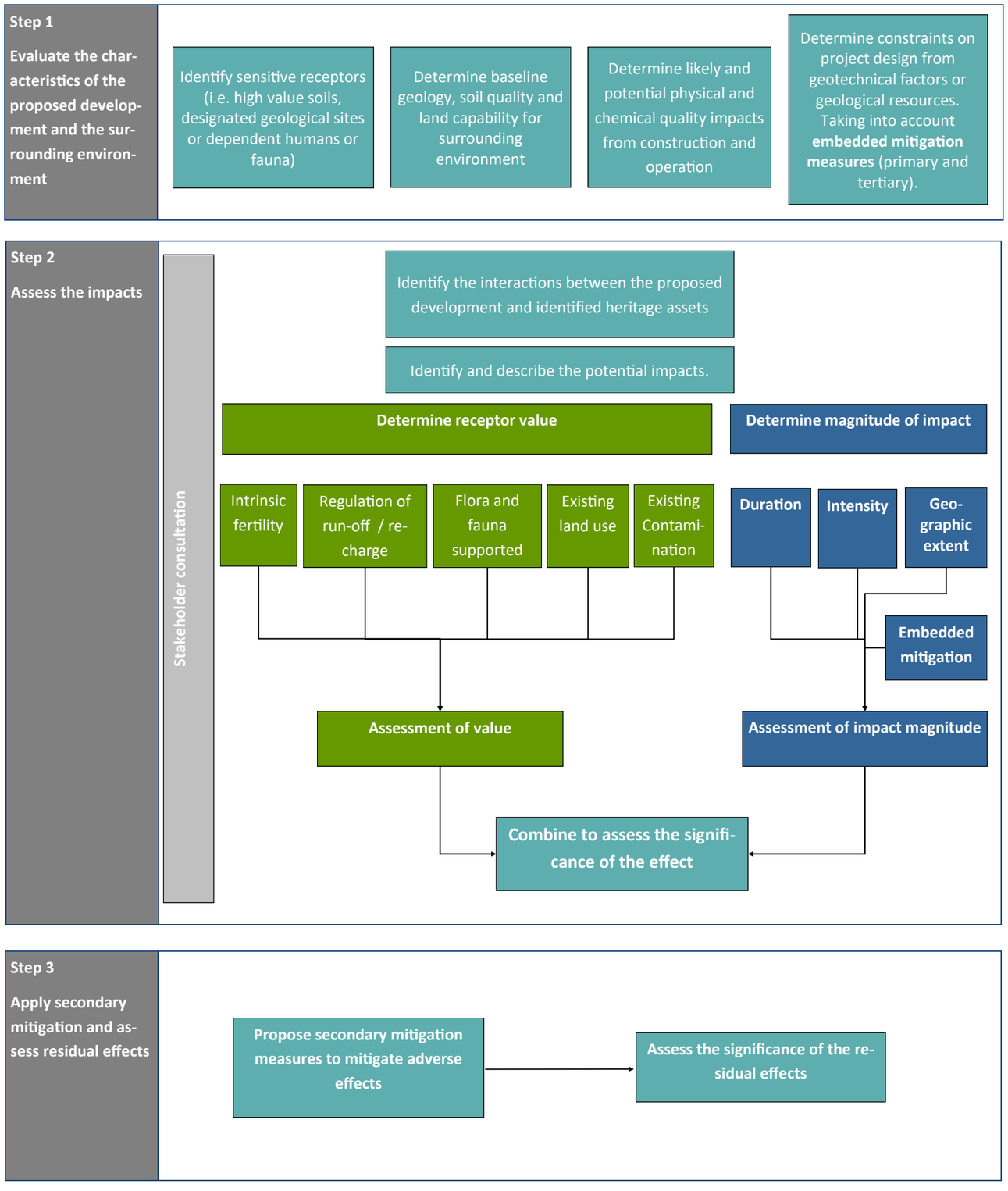


Receptor Value

In the context of geology and soil receptors, four main criteria are considered in determining overall *value* which includes consideration of both receptor sensitivity and vulnerability:

- *Soil quality, structure and sensitivity (ground conditions)*, e.g. whether it has intrinsic agricultural fertility, presence of historical or natural contaminants, degree of anthropogenic disturbance e.g. compaction;
- *Soil ecosystem function as a supporting service* to flora and fauna; e.g. a particular soil type, such as peats, supporting a specific habitat or vulnerable species;
- *Soil ecosystem function as regulating service* for water; e.g. the extent to which whether the soil / geology helps partition rainfall into surface water run-off, evapo-transpiration and groundwater recharge, as well as water retention capacity in the unsaturated zone; and
- *Soil / geologic resource* importance in terms of 'provisioning', e.g. the extent to which the soil is utilised as an agricultural resource, rare geological deposit or minerals safeguarding areas.

Value	Definition / Examples
High	Intensively farmed, highly fertile soils, wetland soils, soils which host shallow aquifers relied upon for abstraction or essential for river baseflow, soils of specific characteristics (e.g. pH, carbon content, mineralogy) that support specific significant or high-value flora or faunal habitats. Geological designates sites (i.e. SSSI's) or rare deposit / mineral resources in region.
Medium	Typical agricultural land, soils supporting specific habitats (e.g. forests), soils on residential sites, locally abundant deposits / regionally important geology, general minerals safeguarding areas.
Low	Low soil fertility not used for agriculture, contaminated made-ground soils at brownfield sites, ground conditions not supporting any particularly sensitive or important habitats.

Magnitude of Change

The magnitude of impacts on soils / geology will be determined by considering the intensity (or scale), spatial coverage and longevity of an impact. The magnitude assigned will also use professional judgement to take into consideration the application of statutory standards and non-statutory standards under international or external guidelines.

Magnitude	Definition / Examples
Large	Change is likely to cause a direct adverse permanent or long-term (i.e. > 10 years) effect on the quality/value of the soil / geological feature over a large area (i.e. >100 ha)
Medium	Change over a moderate (i.e. 1 - 100 ha) to large area, likely to adversely affect the quality/value of the soil / geological feature, but recovery is predicted in the medium term (i.e. 5 -10 years) and there is predicted to be no permanent impact to its integrity. Conversely, change over a small area (i.e. <1 ha) with direct adverse permanent or long-term effects.
Small	Change likely to adversely affect the quality/value of the soil / geology but recovery is expected in the short term (i.e. 1 - 4 years). Changes are over a small to moderate area. Impacts beyond levels of natural variation that do not exceed assessment criteria (i.e. low intensity), for any duration or geographic extent.
Negligible	Change well within the bounds of normal natural variation. No effect detectable or recovery within a very short timescale (<1 year). Could occur over any size of area.

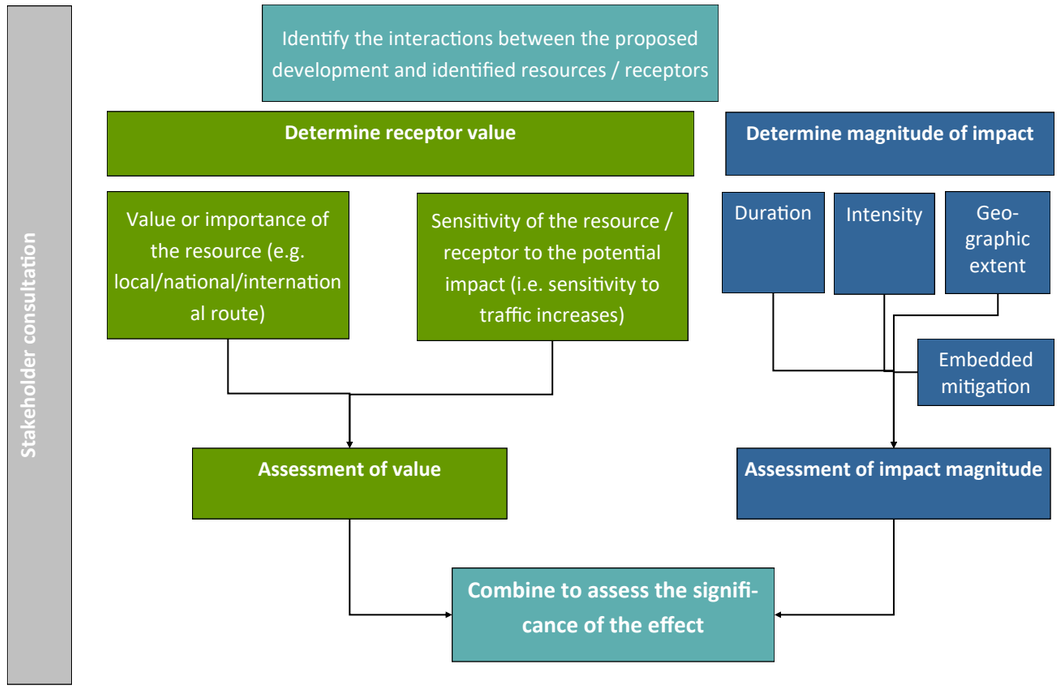
Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

- Identify sensitive receptors (e.g. principal transport routes, congested roads, local facilities sensitive to changes and roads with significant accidents)
- Determine baseline conditions for surrounding environment.
- Determine likely and potential impacts from construction and operation considering traffic flow, road safety, severance, noise, driver delay, pedestrian and cyclist delay, fear and intimidation, air quality and dust and dirt deposits. Taking into account **embedded mitigation measures** (primary and tertiary).

Step 2

Assess the impacts



Step 3

Apply secondary mitigation and assess residual effects

Propose secondary mitigation measures to mitigate adverse effects → **Assess the significance of the residual effects**

The following criteria will be adopted to determine the need for environmental assessment of traffic impacts associated with a development in accordance with IEA Guidelines for the environmental assessment of road traffic.

- include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30%); and
- include any other specifically sensitive areas where traffic flows have increased by 10%, or more."

Increases in traffic flows of less than 10% have a negligible impact as daily variance in traffic flows can be of equal magnitude. The 30% threshold relates to the level at which humans may perceive change and there may therefore be an effect. Impacts above this level therefore do not suggest that there will be a significant impact, only that further consideration is required. The subsequent assessment will be undertaken in accordance with Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5 (2008).

Receptor Value

Value	Criteria	Definition / Examples
Very High	Very High importance and rarity, International or national scale	Key motorway junctions or transport hubs or commercial/government facilities of national importance (ports or airports, motorway crossings, airbases, defence installations etc).
High	National or sub-regional scale and rarity	Major junctions on the SRN, major sub-regional transport interchanges, hospitals, city/town centres and major employment sites.
Medium	Medium importance with local scale	Principal routes on the local highway network, congested local roads/ junctions, roads with a significant number of accidents.
Low	Low importance and rarity, local scale	Main roads through residential areas, cycle routes and roads without pedestrian facilities. Also, important local facilities sensitive to traffic increases including, schools, colleges, playgrounds, retirement homes and doctors surgeries.
Negligible	Negligible importance locally – sub-community or handful of individuals scale	C and Unclassified Roads. Roads with immediately parallel alternative routes. Elements within a road (ie a footway or a partial or lane closure).

Magnitude of Change

The magnitude of impacts on traffic and transport will be determined by considering the amount and intensity of disturbance, duration (such as whether it is temporary or permanent) and geographical extent. The magnitude assigned will also use professional judgement to take into consideration the application of statutory standards and non-statutory standards under international or external guidelines.

Magnitude	Criteria	Definition / Examples
Large	Considerable effect in terms of extent, duration or magnitude that is more than locally significant. In breach of recognised acceptability, legislation or policy or standards	Large change in traffic flows or HGV content, potentially exceeding the capacity of the local highway network.
Medium	Limited effect in terms of extent, duration or magnitude.	Significant change in traffic flows, or HGV content, possibly resulting in issues on parts of the local highway network.
Small	Slight, very short or highly localised	Measurable change in traffic flows, or HGV flows but unlikely to cause significant issues on the local highway network.
Negligible	Very minor loss or detrimental alteration.	Measurable change in traffic flows but within capacity of road network – no disruption predicted

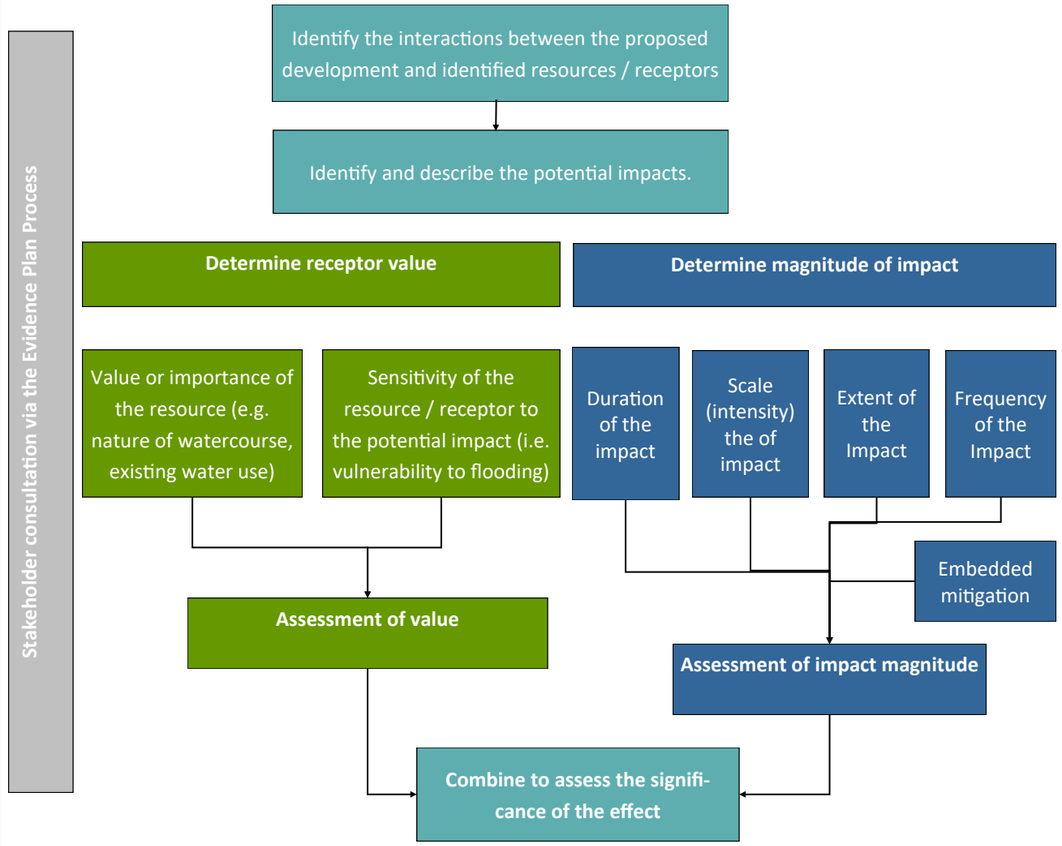
Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

- Define the preliminary scope of the water resources and flood risk assessment study area
- Identify sensitive resources and receptors. Establish the existing baseline conditions, including watercourse type, quality, and resource capacity, and dependent users.
- Determine likely and potential physical and chemical quality impacts from construction, operation, maintenance and decommissioning, taking into account **embedded mitigation measures** (primary and tertiary) .

Step 2

Assess the impacts



Step 3

Apply secondary mitigation and assess residual effects



Importance / Value / Sensitivity

Criteria	Low	Medium	High
Hydromorphology / Physio-chemical (water quality)	Surface water sewer, minor pond or engineered drainage ditch.	Ordinary watercourse with clear natural hydro morphology: such as sinuous planform, natural banks, natural riparian vegetation. Agricultural / private drinking water supply	EA Main River Public drinking water supply
Flood Vulnerability	Water compatible development as defined by NPPF	Less vulnerable development as defined by NPPF	More / highly vulnerable development as defined by NPPF.

Magnitude of Change

Magnitude Criteria	Negligible	Small	Medium	Large
Water quality / reduced value to users	Change is within natural variation	Decrease in quality of water resource, not affecting existing users or changing any WFD element status.	Measurable decrease in surface water chemical quality with potential for deterioration in WFD element status. Reversible change in the quality of a water resource, such that existing users are affected.	Measurable decrease in surface water chemical quality or flow with potential for deterioration in WFD element status. Permanent change in the quality of a water resource, such that existing users are affected.
Quantity / scarcity	Change is within natural variation for the time of year	Decrease in quantity of water resource, not affecting existing users or changing any WFD element status.	Measurable decrease in surface water flow with potential for deterioration in WFD element status. Reversible change in the yield of a water resource, such that existing users are affected.	Measurable decrease in surface water flow with potential for deterioration in WFD element status. Permanent change in the yield of a water resource, such that existing users are affected.
Flooding / Surface water Run-off	No alteration to existing drainage regimes and characteristics	Some alteration to existing drainage regimes and characteristics but not material.	Significant alteration to existing drainage regimes and patterns over a short-term period or localized area.	Significant alteration to existing drainage regimes and patterns over a long-term period for a localized area or a short-term period for a large area.

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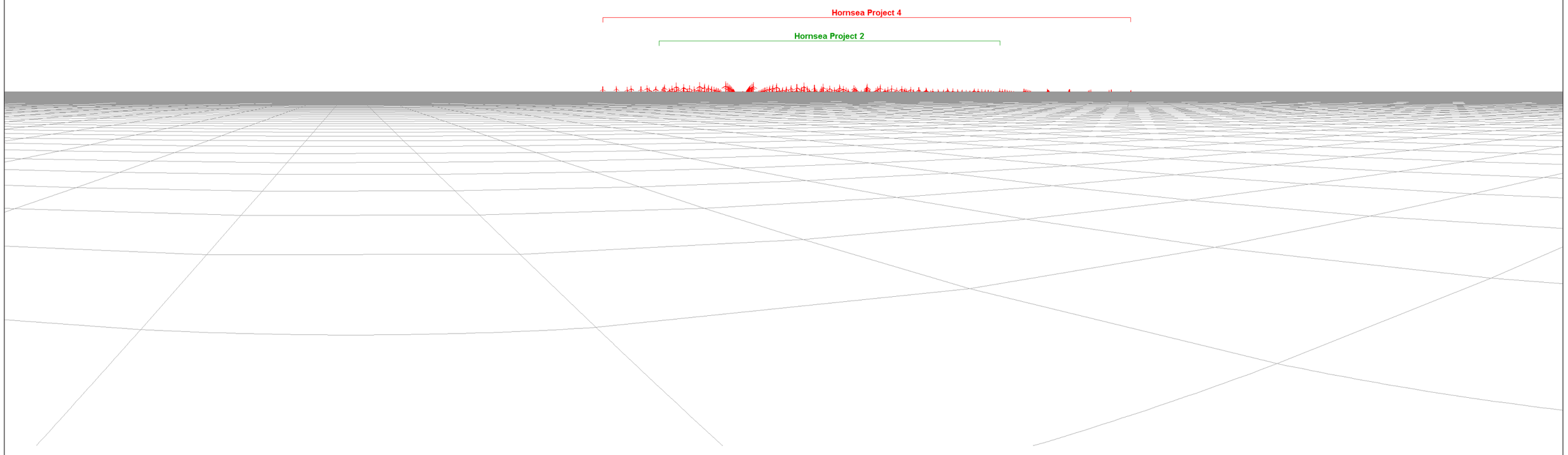
Environmental Impact Assessment: Scoping Report

Annex D SVR Cumulative Wirelines

Hornsea Four

Viewpoint 1: Newcastle - Amsterdam Ferry Route (NW)

Figure: 6.x



Wireline View Colour indicates current status of developments: Proposed Development / Operational and Under Construction / Consented / Scoping

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Coordinate System:	ETRS 1989 UTM Zone 31N	**Horizontal field of view:**	90° (cylindrical projection)
Eye level:	26.5m AOD	**Principal distance**	254.6 mm
Direction of view:	115°	**Paper size:**	420 x 297 mm (A3)

Viewpoint 1: Newcastle - Amsterdam Ferry Route (NW)
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Approved by: LK

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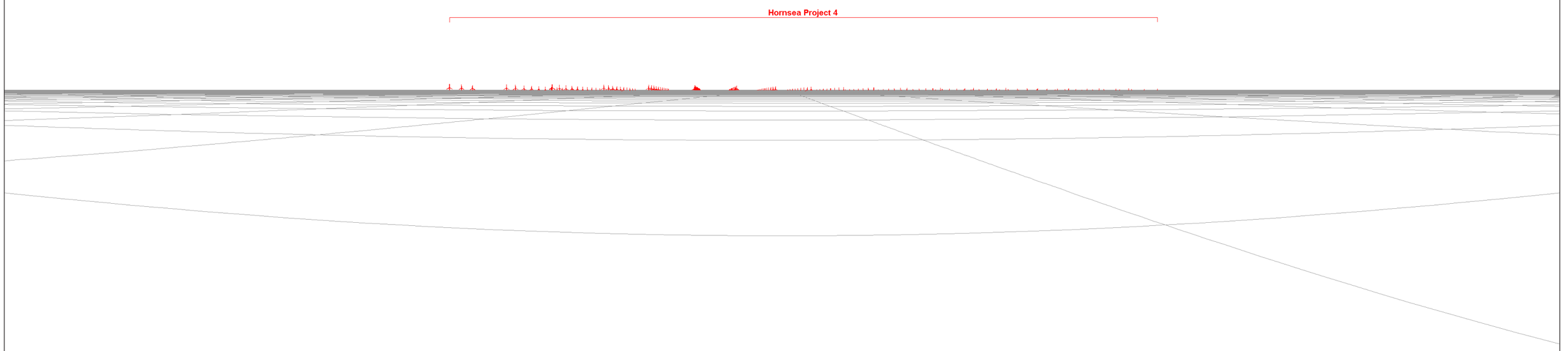
Hornsea Four
Viewpoint 2: RYA Offshore route
Figure: 6.x



Wireline View Colour indicates current status of developments: Proposed Development / Operational and Under Construction / Consented / Scoping

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Direction of view:	90°	**Paper size:**	420 x 297 mm (A3)

Viewpoint 2: RYA Offshore route
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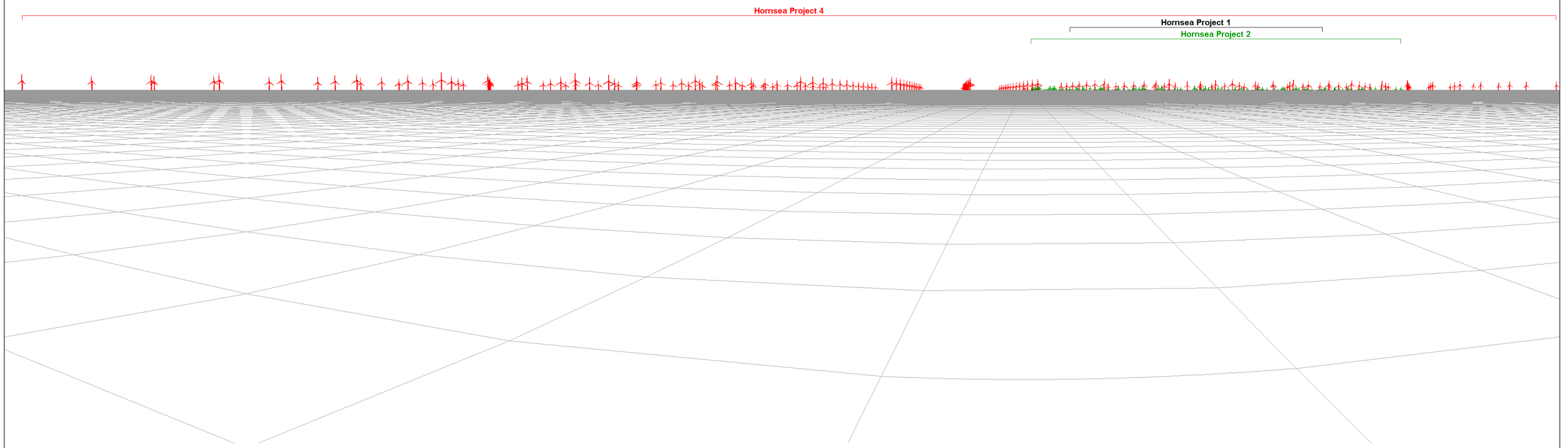
Viewpoint 3: Cleeton Gas Platform

Figure: 6.x



Wireline View Colour indicates current status of developments: Proposed Development / Operational and Under Construction / Consented / Scoping

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Coordinate System:	ETRS 1989 UTM Zone 31N	**Horizontal field of view:**	90° (cylindrical projection)
Eye level:	34.5m AOD	**Principal distance**	254.6 mm
Direction of view:	76°	**Paper size:**	420 x 297 mm (A3)

Viewpoint 3: Cleeton Gas Platform
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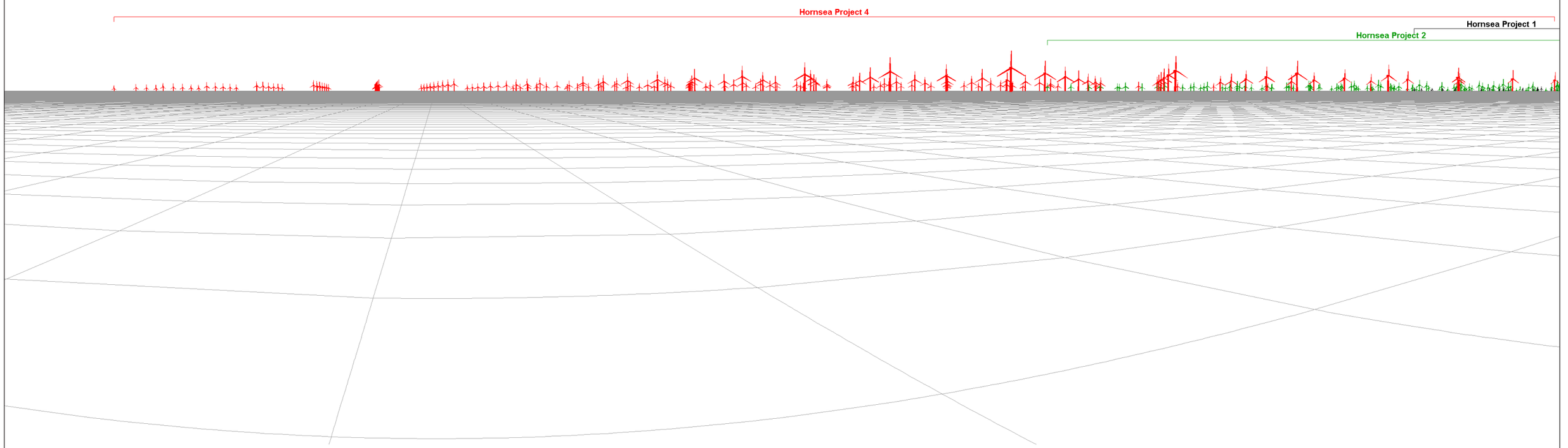
Hornsea Four

Viewpoint 4: Newcastle - Amsterdam Ferry Route (SW)

Figure: 6.x



Wireline View Colour indicates current status of developments: Proposed Development / Operational and Under Construction / Consented / Scoping

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Coordinate System:	ETRS 1989 UTM Zone 31N	**Horizontal field of view:**	90° (cylindrical projection)
Eye level:	26.5m AOD	**Principal distance**	254.6 mm
Direction of view:	20°	**Paper size:**	420 x 297 mm (A3)

Viewpoint 4: Newcastle - Amsterdam Ferry Route (SW)
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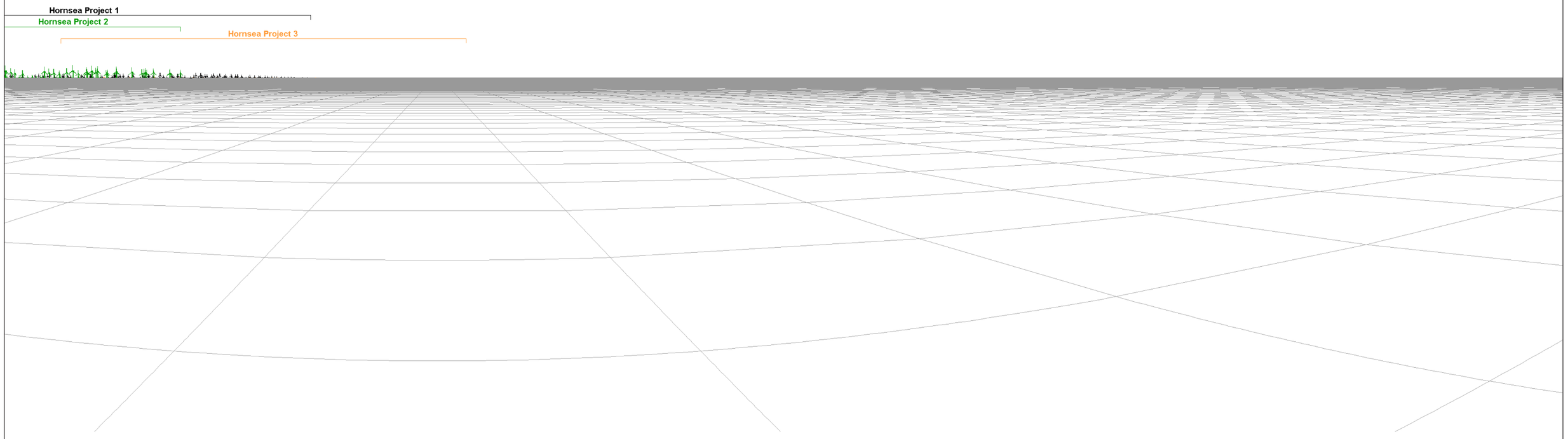
Hornsea Four

Viewpoint 4: Newcastle - Amsterdam Ferry Route (SW)

Figure: 6.x



Wireline View Colour indicates current status of developments: Proposed Development / Operational and Under Construction / Consented / Scoping

OS reference:	377561 E 5960197 N	**Nearest Turbine:**	8,979m
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Eye level:	26.5m AOD	**Principal distance**	254.6 mm
Direction of view:	110°	**Paper size:**	420 x 297 mm (A3)

Viewpoint 4: Newcastle - Amsterdam Ferry Route (SW)
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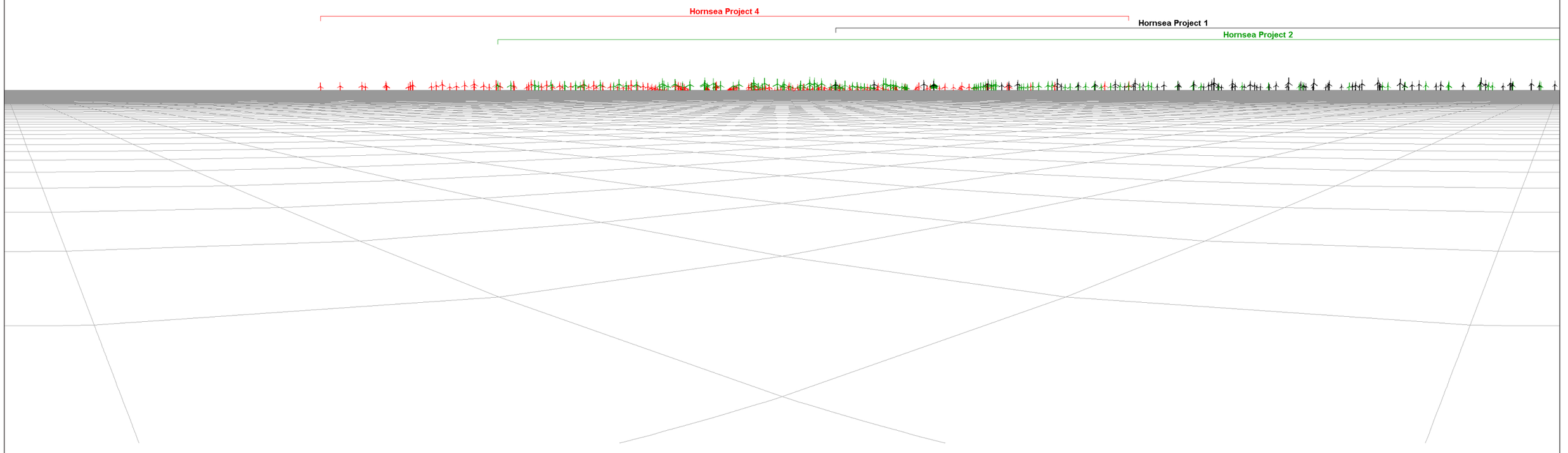
Hornsea Four

Viewpoint 5: Newcastle - Amsterdam Ferry Route (SE)

Figure: 6.x



Wireline View Colour indicates current status of developments: Proposed Development / Operational and Under Construction / Consented / Scoping

OS reference:	423051 E 5950893 N	**Nearest Turbine:**	31,750m
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Eye level:	26.5m AOD	**Principal distance**	254.6 mm
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Viewpoint 5: Newcastle - Amsterdam Ferry Route (SE)
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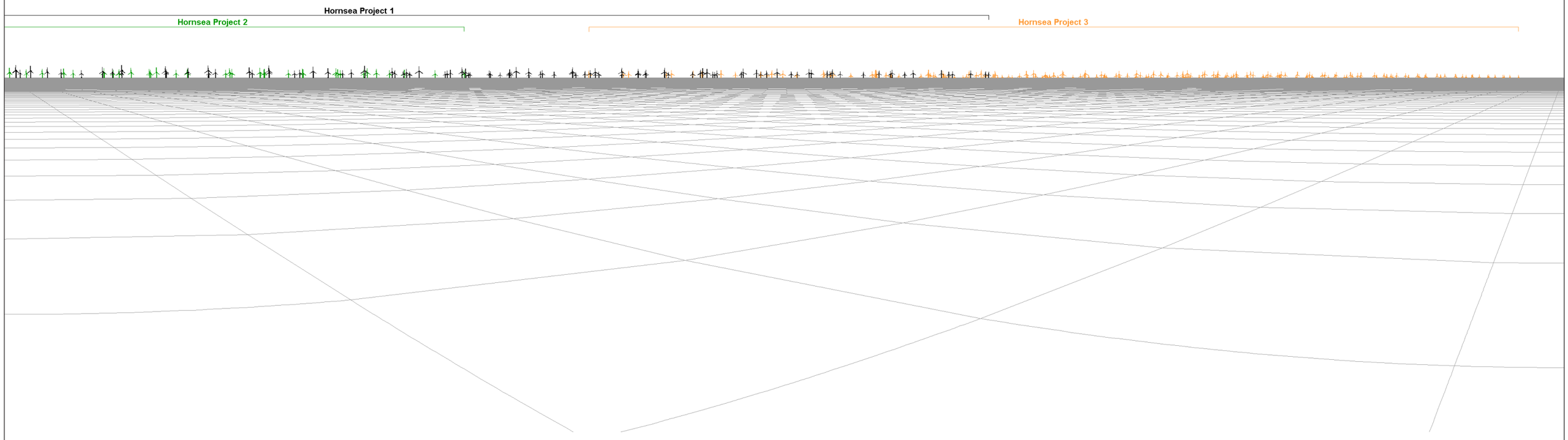
Hornsea Four

Viewpoint 5: Newcastle - Amsterdam Ferry Route (SE)

Figure: 6.x



Wireline View Colour indicates current status of developments: Proposed Development / Operational and Under Construction / Consented / Scoping

OS reference:	423051 E 5950893 N	**Nearest Turbine:**	31,750m
Coordinate System:	ETRS 1989 UTM Zone 31N	**Horizontal field of view:**	90° (cylindrical projection)
Eye level:	26.5m AOD	**Principal distance**	254.6 mm
Direction of view:	45°	**Paper size:**	420 x 297 mm (A3)

Viewpoint 5: Newcastle - Amsterdam Ferry Route (SE)
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Scoping Report

Annex E Water Framework Directive Screening

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Terms and Abbreviations

Term	Definition
BWs	Bathing Waters
cBWD	current Bathing Water Directive
E. Coli	*Escherichia coli*
EQSD	Environmental Quality Standards Directive
HRA	Habitats Regulations Assessment
IE	Intestinal Enterococci
INNS	Invasive Non-Native Species
RBMP	River Basin Management Plan
RIAA	Report to Inform Appropriate Assessment
SAC	Special Areas of Conservation
SFWs	Shellfish Waters
SPA	Special Areas of Protection
rBWD	revised Bathing Water Directive
WFD	Water Framework Directive

1 Introduction

1.1.1.1 This Stage 1[1]Screening Report is intended to determine if there are any activities associated with the Hornsea Four development that require further consideration in respect of the Water Framework Directive (WFD). This screening report will be subject to consultation with the Environment Agency (EA).

1.1.1.2 Subsequently, and where necessary, a Stage 2 Scoping assessment will be prepared for submission as part of the Preliminary Environmental Information report (PEIR) for formal consultation under the requirements of the Planning At 2008 and subsequently, and where necessary, a Stage 3 WFD assessment will be submitted as part of the Development Consent Order (DCO) application to be made to the Planning Inspectorate (PINS).

1.1.1.3 Further information on the stages of the WFD assessment process is set out in Section 3 of this report.

1.1.1.4 It should be noted that the potential for the onshore elements of Hornsea Four to interact with onshore WFD waterbodies has been considered in **Chapter 7** of the EIA Scoping Report. The scoping assessment reviewed the characteristics of all the crossings of surface water through desk-based information together with analysis of high resolution aerial photography. A crossing schedule was developed and is presented in **Annex F**. Hornsea Four commitments to primary embedded mitigation in regard to water crossings, specifically the following.

- All natural watercourses including main rivers and ordinary watercourses (not artificial drainage ditches, flood defences), main roads and railways will be crossed by HDD or other trenchless technology where technically practical.

- Where HDD technologies are not required or practical, the crossing of drainage ditches or engineered channels may be undertaken by open cut methods and / or the installation of temporary culverts or bridges to allow water to continue flowing. This will be in line with advice notes, guidance documents and additional information including Environment Agency Pollution Prevention Guidelines (PPGs) will be adhered to, particularly: • PPG01 General Guide to the Prevention of Water Pollution; • PPG02 Above Ground Oil Storage Tanks; • PPG04 Disposal of Sewage where no Mains Drainage is Available; • PPG05: Works in, Near or Liable to Affect Watercourses; • PPG06: Working at Construction and Demolition Sites; • PPG08 Safe Storage and Disposal of Used Oils; • PPG21: Pollution Incident Response Planning; and • Pollution Prevention: Major Pipeline.

1.1.1.5 On the basis of the EIA scoping assessment and commitment to mitigation already adopted by Hornsea Four it is anticipated that Hornsea Four is unlikely to result in any significant effects on surface watercourses or groundwater bodies and at this stage a WFD Compliance Assessment is not considered necessary. Further justification for this approach

[1] Aligned with the WFD assessment stages set out in the EA's "Water Framework Directive assessment: estuarine and coastal waters" guidance (https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters).

will be presented during the consultation process, and should details come to light following scoping which suggest that effects on waterbodies may occur, the scope for a WFD compliance assessment will be discussed with the EA at such time.

1.2 Background

1.2.1 The Water Framework Directive

1.2.1.1 The WFD[2] was adopted and came into force in 2000 and represents a culmination in European Union (EU) water resource protection. It establishes a legislative framework for the protection of surface waters (including rivers, lakes, transitional waters and coastal waters (up to 1 nautical mile (NM) from the coast) and estuaries)) and groundwater throughout the EU. The WFD is transposed into law in England and Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the 2017 Regulations).

1.2.1.2 Each water body has been assigned an ecological status, which considers the hydromorphology, biology (in terms of fish and habitats), water quality (in terms of chemical indicators) and the proximity of protected areas. The different statuses that may be assigned to a given water body are as follows:

- High;
- Good;
- Moderate;
- Poor; or
- Bad

1.2.1.3 The current WFD status for each water body is set out in the 2015 River Basin Management Plans (RBMPs). There are eight RBMPs covering watercourses and coastal water bodies in England and Wales.

1.2.1.4 In relation to the coastal water bodies and the offshore aspects of the Hornsea Four development, the relevant RBMP is the Humber River Basin District RBMP[3].

1.2.1.5 Monitoring of the aquatic environment in relation to physical, chemical and biological parameters started in 2006 with a view to ensuring a 'good ecological status' of all surface water bodies. Chemical and biological Environmental Quality Indicators are used, and a programme of measures is implemented in order to improve surface waters that do not meet the required status.

1.2.1.6 The WFD's objective of "Good chemical status" is defined in terms of compliance with all of the quality standards established for chemical substances at a European level. The Directive also provides a mechanism for renewing these standards and establishing new ones by means of a prioritisation mechanism for hazardous chemicals. This will ensure at least a minimum chemical quality, particularly in relation to very toxic substances.

[2] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (the 'Water Framework Directive').

[3] Available at: https://www.gov.uk/government/publications/humber-river-basin-district-river-basin-management-plan

1.2.1.7 The WFD's objective of a "Good ecological status" also requires certain chemical conditions. The chemical requirements include the achievement of environmental quality objectives for discharged Priority Substances and for any other substances liable to cause pollution and identified as being discharged in significant quantities.

1.2.1.8 Using the EA's "Clearing the Waters for All" guidance (Environment Agency 2016) and PINS Advice note 18 (PINS, 2017), a WFD screening assessment of the potential for Hornsea Four to have a significant non-temporary effect on WFD parameters at a water body level has been carried out. Advice Note 18 states that "applicants are invited to use the formal EIA scoping procedures to submit information identifying the water bodies within relevant RBMPs likely to be impacted by the Proposed Development". This has been undertaken based on the Hornsea Four Project Description, detailed in Chapter 3, and where the requirement for further assessment has been identified, this will be presented in full in the PEIR, based on refined project information and the outcomes of the topic specific assessments.

1.2.2 Shellfish Waters

1.2.2.1 The WFD also incorporates the consideration of the requirements of the Shellfish Waters Directive which aims to protect and improve water quality and support the growth of healthy shellfish (bivalve and gastropod molluscs) and contribute to good quality edible shellfish.

1.2.2.2 The Directive establishes parameters applicable to designated Shellfish Waters (SFWs), as well as indicative values, mandatory values, reference methods of analysis and the minimum frequency for taking samples and measurements. These parameters are set for pH, temperature, salinity and the presence or concentration of certain substances (dissolved oxygen, hydrocarbons, metals, organohalogenated substances, etc.).

1.2.2.3 Additionally, the Directive stipulates that a discharge should not cause an increase in suspended solids that exceeds 30% above background levels, as shellfish can be adversely affected by the smothering effects of settling sediment.

1.2.3 Bathing Waters

1.2.3.1 In addition, the WFD incorporates a consideration of the requirements of the Bathing Water Directive. The EU's revised Bathing Water Directive (rBWD) (2006/7/EC) came into force in March 2006 and replaced the then current Bathing Water Directive (cBWD) (76/1160/EEC). The rBWD provided more stringent standards than the cBWD and placed an emphasis on providing information to the public.

1.2.3.2 The rBWD sets out four different classifications of bathing water performance:

- Excellent – the highest, cleanest class;
- Good – generally good water quality;

- Sufficient – the water meets minimum standards; and
- Poor – the water has not met the minimum required standards.

1.2.3.3 The EA measures, monitors and reports the number of certain types of bacteria which are markers of the presence of pollution, mainly from sewage or animal faeces. *Escherichia coli* (*E.coli*) and Intestinal Enterococci (IE) are bacteria that indicate the presence of faeces, with an increase in concentration indicative of a decrease in water quality.

1.2.3.4 The EA collect approximately 20 samples from each Bathing Water (BW) each year during the Bathing Season (15th May to 30th September in England). An overall classification for the BW is then determined by creating a distribution from the monitoring data for the last four years (4 years x 20 samples = distribution of 80 samples). A separate distribution is calculated for both *E.Coli* and I.E. The 95th and 90th percentile values from each distribution are calculated. This then enables the determination of the classification for each bacterium for the BW. This is relevant in so far as the activities associated with the development of Hornsea Four have the potential to affect the classification of the BWs in the vicinity for up to four years after the proposed activities commence.

1.3 The Requirement to Consider the WFD in the Context of the Planning Act 2008

1.3.1.1 Consideration of the WFD (2000/60/EC) is a requirement for any developer wishing to make a DCO application for Nationally Significant Infrastructure Projects (NSIPs) particularly in coastal and estuarine areas, and where the proposed development has the potential to cause a deterioration in the ecological and chemical status of a water body or to compromise improvements which might otherwise lead to a water body meeting its WFD objectives. The WFD aims to protect and enhance water bodies within Europe and covers all estuarine and coastal waters out to 1 NM (See **Figure 1**).

Hornsea Four
Water Framework Directive Relevant Water Body and Protected Areas
Figure 1

280000 290000 300000 310000 320000 330000

6010000 6000000 5990000 5980000

Flamborough Head SAC

Flamborough Head and Bempton Cliffs SPA

Bridlington South Beach

Wilsthorpe

Fraisthorpe

Yorkshire South

Greater Wash SPA

Skipsea

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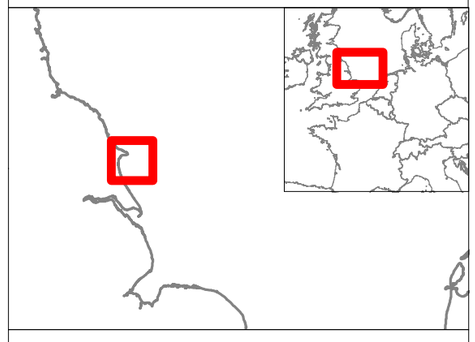
- Scoping Boundary
- Scoping Boundary 2km Buffer
- Coastline 1nm Buffer
- Water Framework Directive Coastal Waterbody
- SPAs
- Flamborough Head SAC
- Designated BWs
- Bathing Water Monitoring Location



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Scale@A3: 1:182000

0 1 2 4 6 8 Kilometres

0 0.5 1 2 Nautical Miles

Water Framework Directive Relevant Water Body and Protected Areas
Document no: H4SR_AN01
Created by: LS
Checked by: CC
Approved by: LK

RS89

2 Project Overview

2.1.1.1 This preliminary WFD screening assessment focuses on those elements of Hornsea Four relevant to the offshore/coastal areas designated for WFD consideration. As such, the construction activities of relevance relate to the proposed activities that will occur below Mean High Water Springs (MHWS). Rivers and ground waters have been separately considered in the EIA Scoping Report.

2.1.1.2 Of specific relevance to the WFD assessment are those components with the potential for effect-receptor pathways between Hornsea Four and WFD water bodies. The minimum distance between the Hornsea Four array area (the area within which the main wind farm project will be located) and the coastline is 65 km, therefore the relevant components are limited only to the installation of the export cables (which will transfer power from the offshore substations to the landfall (and onwards to the onshore substation at Creyke Beck)) where they approach landfall,. Up to six export cables will be required for Hornsea Four, located within the offshore Export Cable Corridor (ECC) which will make landfall at the Yorkshire coast, south of Bridlington.

2.1.1.3 The exact location and orientation of the ECC and landfall will be determined during an iterative route planning process following the granting of the DCO. For the purpose of this assessment, the scoping boundary for the ECC has been used as the project boundary (see **Figure 1**).

2.1.1.4 Drawing on the information outlined in Chapter 3: Project Description of the Scoping Report, the primary effects associated with the installation of the Hornsea Four export cable that are considered to be relevant to the WFD assessment are:

- Offshore cable installation (offshore export cable installation via trenching, dredging, jetting, ploughing or vertical injection); and
- The installation of the export cables at the cable landfall at the Yorkshire coast, south of Bridlington and across the intertidal area via Horizontal Directional Drilling (HDD), trenching, dredging, jetting, ploughing, rock cutting or vertical injection.

3 WFD Assessment Methodology

3.1.1.1 The EA is currently aiming to achieve "Good status" in at least 60% of waters by 2021 and in as many waters as possible by 2027 (EA, 2015). This comprises two parts, the first of which is "Good ecological status" (or "Good ecological potential" for water bodies classed as heavily modified or artificial). This includes biological, hydromorphological and physicochemical quality elements and specific pollutants. The second part is "Good chemical status" and concerns a series of Priority Substances, including Priority Hazardous Substances. The WFD also requires that relevant protected area objectives are achieved.

3.1.1.2 The screening exercise in this report follows the latest EA (2016) 'Clearing the Waters for All' guidance and PINS Advice Note 18 (PINS, 2017) for assessing impacts in the estuarine (transitional) and coastal waters for the WFD. Screening is the first of three potential stages, with the need to undertake later stages dependent on the outcome of the preceding stages.

3.1.1.3 Advice Note 18 provides a description of the WFD process broken down into the three distinct stages, the first of which (screening) is presented in this document:

- **Stage 1** – WFD screening –to determine if there are any activities associated with the Proposed Development that don't require further consideration, for example activities which have been ongoing since before the current RBMP plan cycle and which have thus formed part of the baseline;
- **Stage 2** – WFD scoping – to identify risks of the Proposed Development's activities to receptors based on the relevant water bodies and their water quality elements (including information on status, objectives, and the parameters for each water body); and
- **Stage 3** – WFD impact assessment – a detailed assessment of water bodies and their quality elements that are considered likely to be affected by the Proposed Development, identification of any areas of noncompliance; consideration of mitigation measures, enhancements, and contributions to the RBMP objectives. Where the potential for deterioration of water bodies is identified, and it is not possible to mitigate the impacts to a level where deterioration can be avoided17, the project would need to be assessed in the context of Article 4.7 of the Directive (see Section 4 of this Advice Note for further advice on derogation). Where a derogation is necessary, Applicants will need to provide the necessary information to justify their case, bearing in mind that Applicants must always seek to avoid deterioration of the water environment. It is a matter for the SoS to consider whether derogation under Article 4.7 is justified in relation to a Proposed Development.

3.1.1.4 Advice Note 18 states that "applicants are invited to use the formal EIA scoping procedures to submit information identifying the water bodies within relevant RBMPs likely to be impacted by the Proposed Development". This has been undertaken based on the Hornsea Four Project Description, detailed in Chapter 3 of the Scoping Report. Where the requirement for further assessment has been identified, this will be presented as a Stage 2 scoping assessment in the PEIR based on refined project information and the outcomes of the relevant, detailed topic specific assessments that will also be set out in the PEIR documents.

3.1.1.5 This Stage 1 assessment is reliant on identifying those effects that are non-temporary. For this purpose, non-temporary is defined as:

"Non-temporary: A period of time that is greater than the recommended monitoring period interval as stated by the WFD (2000/60/EC)".

3.1.1.6 Different monitoring periods are defined for different parameters under the WFD. In this assessment, the monitoring period interval is aligned with that of the relevant RBMP, which is understood to be six years.

4 WFD Assessment Criteria

4.1.1.1 The WFD assessment will consider each stage of activity (construction, operation and maintenance, and decommissioning) of Hornsea Four insofar as they are relevant to the WFD assessment (as defined under Section 3 above). The receptors are:

- Hydromorphology;
- Biology- habitats;
- Biology – fish;
- Water quality;
- Protected areas; and
- Invasive Non-Native Species (INNS).

4.1.1.2 Hydromorphology in this assessment is defined as the physical characteristics of the water body, including the size, shape, structure; and for marine bodies, the flow and quantity of water and sediment.

4.1.1.3 Biological habitats (both those designated as higher and lower sensitivity habitats) will be considered if the footprint of the proposed activities is any of the following:

- 0.5 km^2 or larger;
- 1% or more of the water body's area;
- Within 500 m of any higher sensitivity habitat; or
- 1% or more of any lower sensitivity habitat.

4.1.1.4 The impacts resulting from the proposed activities on water quality will be assessed according to:

- Whether or not they affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring-neap tidal cycle (approximately 14 days);
- Whether or not they impact a water body/water bodies with a phytoplankton status of moderate, poor or bad; or
- Whether the water body/ water bodies have a history of harmful algal blooms.

4.1.1.5 The impacts will be also be considered on WFD protected bathing waters (BWs), shellfish waters (SFWs) and Nutrient Sensitive Areas (NSAs).

4.1.1.6 As part of the DCO application for Hornsea Four, a separate Habitats Regulation Assessment (HRA) (Report to Inform Appropriate Assessment (RIAA)) will be undertaken to assess the potential impacts on Special Areas of Conservation (SAC), Special Areas of Protection (SPA) and Ramsar sites, and their associated features.

5 Stage 1 Screening

5.1 Relevant WFD Water Bodies

5.1.1.1 Offshore water bodies have been considered in this assessment. As required under the EA (2016) guidance, water bodies were identified based on the following criteria (which are illustrated in Figure 1).

- Any offshore designated site, of relevance to the WFD, within 2 km of the project boundary;
- Any WFD waterbody within 2 km of the project boundary; and
- Any priority habitat within 500 m of the project boundary.

5.1.1.2 The proposed offshore ECC lies within the Yorkshire South water body (GB640402491000) (see Figure 1). This coastal type waterbody has been screened-in.

5.2 Protected areas

5.2.1.1 All screened-in protected areas are presented in Figure 1 Further information about the reasons and features of the designated sites for nature conservation (SACs and SPAs) can be found in the HRA Screening Report which accompanies the EIA Scoping Report.

5.2.1.2 As required under the EA (2016) guidance the following designations have been considered in this WFD assessment:

- SACs;
- SPAs;
- BWs;
- SFWs; and
- NSAs.

5.2.1.3 The following designated sites are located within 2 km of the Hornsea Four offshore ECC scoping boundary:

5.2.2 Flamborough Head SAC

5.2.2.1 Flamborough Head SAC falls within 2 km of the scoping boundary for the Hornsea Four offshore ECC. The primary designation feature for this site is the presence of Annex I habitats.

5.2.3 Flamborough Head and Bempton Cliffs SPA

5.2.3.1 The Flamborough Head and Bempton Cliffs SPA falls within 2 km of the scoping boundary for the Hornsea Four offshore ECC. The primary designation for this site is to support populations of kittiwake (*Rissa tridactyla*), and a seabird assemblage of puffin (*Fratercula artica*), razorbill (*Alca torda*), guillemot (*Uria aalge*), herring gull (*Larus argentatus*), and gannet (*Morus bassanus*).

5.2.4 Greater Wash SPA

5.2.4.1 The Greater Wash SPA crosses the Hornsea Four offshore ECC scoping boundary. The primary designation for this site is to support populations of red-throated diver (*Gavia stellata*), little gull (*Hydrocoloeus minutus*) sandwich tern (*Sterna sandivicensis*), common tern (*Sterna hirundo*) and little tern (*Sternula albifrons*).

5.3 Bathing and Shellfish waters

5.3.1.1 The screened-in BWs within 2 km of the Hornsea Four offshore ECC scoping boundary (see Figure 1) are:

- Bridlington South Beach BW
- Wilsthorpe BW
- Fraisthorpe BW
- Skipsea BW

5.3.1.2 There are no screened-in SFWs within 2 km of the Hornsea Four offshore ECC scoping boundary.

5.3.1.3 There are no screened-in NSAs within 2 km of the Hornsea Four offshore ECC scoping boundary.

5.4 Status of relevant water bodies

5.4.1.1 The current status of the screened-in water body and protected areas (specifically BWs) are presented in Table 5-1 and Table 5-2 respectively.

5.4.1.2 The higher and lower sensitivity biological habitat areas for the screened-in water body are presented in Table 5-3.

Table 5-1 Current status of the identified water body

Water body	Yorkshire South
ID	GB640402491000
Type	Coastal
Distance from ECC scoping boundary (km)	0
Water body area (ha)	15836.87
Overall Current Status	Moderate
Current Status (Ecological)	Moderate
Current Status (Chemical)	Good
Target Status	Good
Is the water body heavily modified (HMWB)?	Yes
Reason for HMWB	Coastal protection, flood protection and navigation, ports and harbours.
Hydromorphology Status	Supports Good
WFD Phytoplankton Classification	High
History of Harmful Algae?	Not Monitored

Table 5-2: Most recent (complete) status reports for the relevant BWs

Water Body	Bridlington South Beach	Wilsthorpe	Fraisthorpe	Skipsea
ID	uke1200-08100	uke1200-08200	uke1200-08300	uke1200-08600
Type	BW	BW	BW	BW
Distance from ECC scoping boundary (km)	0.54	0	0	0.38
Classification: 2017	Good	Good	Good	Good
Classification: 2016	Good	Good	Good	Good
Classification: 2015	Good	Good	Good	Good
Classification: 2014	Good	Good	Good	Excellent

5.4.1.3 Although there are some Higher Sensitivity Habitats present within the Yorkshire South water body as a whole (see **Table 5-3**), an analysis of the area using the MAGiC mapping tool (Natural England, 2018) has indicated that none are present within 2 km of the Hornsea Four offshore ECC scoping boundary; further consideration of these habitats is therefore screened out.

5.4.1.4 The following Lower Sensitivity Habitats fall within 2 km of the offshore ECC scoping boundary and will therefore be considered in the Stage 2 Scoping assessment (all others will be screened out):

- Cobbles, gravel and shingle;
- Subtidal rocky reef; and
- Subtidal soft sediment.

Table 5-3: Higher and lower sensitivity habitats in the identified waterbody (Environment Agency, 2016)

Characterisation	Habitat	Hectares in water body (ha)	Screened in?
Higher Sensitivity Habitats	Chalk reef	-	×
	Clam, cockle and oyster beds	-	×
	Intertidal seagrass	-	×
	Maerl	-	×
	Mussel beds, including blue and horse mussel	0.29	×
	Polychaete reef	-	×
	Saltmarsh	-	×
	Subtidal kelp beds	349.12	×
	Subtidal seagrass	-	×
Lower Sensitivity Habitats	Cobbles, gravel and shingle	299.38	✓
	Intertidal soft sediment	680.83	×
	Rocky shore	7.59	×

Characterisation	Habitat	Hectares in water body (ha)	Screened in?
	Subtidal boulder fields	-	×
	Subtidal rocky reef	860.94	✓
	Subtidal soft sediments	20779.33	✓

5.5 Proposed Activities and associated potential impacts

5.5.1.1 The proposed activities throughout the lifetime of Hornsea Four which are considered to have the potential to have an impact on WFD waterbodies are outlined in detail in Chapter 3: Project Description and summarised in Section **Error! Reference source not found.** above. T he potential impacts associated with the relevant proposed activities are summarised in **Table 5-4** below.

Table 5-4: Potential Impacts Arising from the Hornsea Four Development

Potential Impact	
Construction	
Effects on sediments and sedimentary structures	Construction would not alter the geology of the site, particularly the strata which are below the level at which construction activity will occur (for cable installation this would be limited to the surface few metres). There could be localised scour effects in the immediate vicinity of any cable protection required in terms of bed formations.
Accidental Pollution	There is a risk of pollution being accidentally released from vessels and machinery used in the project, including construction and installation vessels and from the construction process itself. Such pollution could affect the sediment and water quality, with potential secondary implications for the benthos.
Effects on suspended sediment concentrations and transport	There would be short-term increases in suspended sediment levels as a result of ground preparation and cable installation. The methods used for installation would affect the amount of sediment which is displaced, but it is also considered that the impacts would be localised and not spread at a significant level outside the footprint of the offshore ECC; therefore, there will be no impacts on morphological conditions.
Resuspension of EQS substances (including bacteria) from sediments	There would be short term increases in suspended sediment, with the potential for the release of EQS substances (if present in sediments) as a result of ground preparation and cable installation.
Short-term impacts on low-priority habitats	Depending on the selected method of export cable installation, there may be short term impacts on the low priority habitats in the area, namely: gravel and cobbles; subtidal rocky reef; and subtidal soft sediment.
Operations and Maintenance	
Accidental pollution	There is a risk of pollution being accidentally released from vessels and machinery used by the project, for example during maintenance operations. Such pollution could affect the sediment and water quality, with potential secondary implications for the benthos.
Resuspension of EQS substances (including bacteria) from sediments during O&M	Should scour occur in the offshore ECC around cable protection this could result in a release of suspended sediment into the water column. EQS substances may be present in the suspended sediments. Scour is considered only for the O&M phase. However, the degree of sediment disturbance will be much reduced when compared to the construction phase.
Effects to hydrodynamic regime (waves and tidal currents)	Structures in the WFD water body such as cable crossings may affect the hydrodynamic regime and will be considered in line with the project design in the PEIR and in the final Environmental Statement (ES).
Potential Artificial Reef Creation	It is likely that the manmade structures placed on the seabed, such as at cable crossings, will be colonised by a range of marine species resulting in a localised increase in biodiversity. These structures also have the potential to act as 'artificial reefs', however they may also support non-native species.

5.5.1.2 A full scoping assessment for all elements identified for the Yorkshire South coastal water body and bathing waters within 2 km of the Hornsea Four offshore ECC scoping boundary will be presented in the PEIR as part of the Stage 2 assessment.

5.5.1.3 Shellfish waters and Nutrient Sensitive Areas have been screened out of any further consideration in the Stage 2 Scoping Assessment.

6 References

Environment Agency (2016), Clearing the Waters for All, Water Framework Directive assessment: estuarine and coastal waters. https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters [Accessed August 2018]

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Hornsea 4

Ørsted



Environmental Impact Assessment: Scoping Report

Annex F Marine Conservation Zone Assessment

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Terms and Abbreviations

Term	Definition
cSAC	candidate Special Area of Conservation
Defra	Department for Environment, Food, Resource and Agriculture
DCO	Development Consent Order
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ES	Environmental Statement
HRA	Habitats Regulations Assessment
MCAA	Marine and Coastal Access Act 2009
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
OSPAR	Oslo and Paris Convention for the Protection of the North East Atlantic
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
rMCZ	Recommended Marine Conservation Zone
SNCB	Statutory Nature Conservation Body

1 Introduction

1.1.1.1 The designation process for Marine Conservation Zones (MCZs) and their management is provided for within Part 5, Chapter 1 of the Marine and Coastal Access Act 2009 (MCAA; Her Majesty's Stationery Office, 2009). This legislation sets out how the appropriate authorities (Welsh Ministers, Scottish Ministers and Secretary of State) are responsible for the identification and proposal of marine ecological and geological features that would benefit from designation as MCZs, as well as for the conservation and management of designated MCZs, their features and their conservation objectives.

1.1.1.2 Clause 126 of Part 5, Chapter 1 states that any person seeking authorisation to undertake an activity that may affect (other than insignificantly) the protected features of an MCZ, or any ecological or geomorphological processes on which the conservation of any protected feature of an MCZ is (wholly or in part) dependent must demonstrate that there will be no significant risk of the activity hindering the achievement of the conservation objectives stated for the MCZ. This demonstration of no significant risk is referred to as an 'MCZ assessment'. If this cannot be demonstrated, the MCZ assessment will also consider whether Clause 127(7) can be met. This requires the demonstration that there is no other means of proceeding with the activity which would create a substantially lower risk of hindering the achievement of the conservation objectives, that the benefit to the public of proceeding with the activity clearly outweighs the risk of damage to the environment that will be created by proceeding with it, and that the person seeking the authorisation will undertake, or make arrangements for the undertaking of, measures of equivalent environmental benefit to the damage which the act will or is likely to have in or on the MCZ.

1.1.1.3 Guidance documents that assist with the completion of an MCZ assessment include:

- Marine Management Organisation (MMO) (2013). 'Marine Conservation Zones and Marine Licensing'; and
- Royal Haskoning (2015). Marine Conservation Zone Assessment Guidance. June 2015.

1.1.1.4 In order to determine whether an MCZ assessment is required for a proposed activity or not, an initial screening exercise is required to establish whether the proposed activity is within, or near to, an MCZ. The MMO recommends the use of a risk-based approach when determining the 'nearness' of an activity to MCZs, including applying an appropriate buffer zone to the MCZ features under consideration as well as a consideration of risks for activities at greater distances from features of the MCZ(s). If, through screening, the proposed activity is within, or near to, an MCZ, there may be a potential significant impact upon the MCZ and therefore a MCZ assessment is required. The persons seeking authorisation (the applicant) need to provide information to the public authority to facilitate the MCZ assessment, but it is the MMO that undertakes the assessment and concludes on whether there will be an effect as part of the Marine Licensing process.

1.1.1.5 The MMO has produced a guidance document (MMO, 2013) that sets out the two-staged approach that is adopted for undertaking an MCZ assessment:

- **Stage 1 Assessment** – At Stage 1, the MMO considers whether there is a significant risk of the activity hindering the conservation objectives of an MCZ. If so,

then the applicant must consider whether there are other means of proceeding. If mitigation to reduce the impacts to an acceptable level cannot be secured, and there are no other alternative locations, then a Stage 2 assessment follows; and

- **Stage 2 Assessment** – The applicant must demonstrate that the benefit to the public of granting the licence clearly outweighs the risk of damage to the environment and that the applicant will carry out or procure the carrying out of measures of equivalent environmental benefit to offset the damage (compensatory measures).

1.1.1.6 This report presents the results of a preliminary screening of designated MCZs and identifies sites that will, it is proposed, be carried forward for consideration within the Stage 1 assessment to be included within the Preliminary Environmental Information Report (PEIR). This report also provides a summary of the proposed approach to the MCZ assessment for Hornsea Four (where required).

2 Preliminary MCZ Screening for Hornsea Four

2.1.1.1 The MMO guidance (2013) states that MCZ assessment will apply to proposed MCZs (together with their proposed features and considering the proposed conservation objectives) until their point of designation. From designation, it is only the designated MCZ (and features / conservation objectives) that are then relevant. The MMO does however also state that "MCZ sites and features identified as possible candidates for designation in future tranches will not be subject to the MCZ assessment process." This advice would therefore suggest that only formally proposed recommended MCZs (rMCZs) and designated MCZs that have been or are undergoing public consultation or have been designated by the Government need to be assessed. The wider lists of MCZs recommended to the Government by the Regional MCZ Projects do not require assessment. Along with Tranches 1 and 2, this advice would therefore include the rMCZs that are currently being consulted upon (June 2018) as part of Tranche 3. In addition, from previous experience of e.g. Hornsea Project Three and other projects including the East Anglia THREE offshore wind farm, requests have been made in the past to complete MCZ assessments to cover rMCZ (as suggested within the Royal Haskoning 2015 guidance).

2.1.1.2 On this basis, Hornsea Four intends to screen both designated MCZ and rMCZs that are within, or near to, the Hornsea Four array area and offshore ECC, into the Stage 1 Assessment on the basis that the construction, operation, maintenance and decommissioning phases of Hornsea Four may have the potential to directly and indirectly affect the interest features of these sites. On that basis, the following MCZ / rMCZ are identified as being relevant:

- Holderness Inshore MCZ– The offshore ECC just overlaps with the northernmost extent of this MCZ; and
- Holderness Offshore rMCZ – The offshore ECC just overlaps with the northernmost extent of this rMCZ.

2.1.1.3 The location of these sites is shown on Figure 1 with their designated features, conservation objectives, and general management approach presented in Table 1.

Hornsea Four
Location of Marine Conservation Zones (MCZ) and recommended MCZs
Figure 1

300000 350000 400000

6000000

5950000

N

GRID NORTH

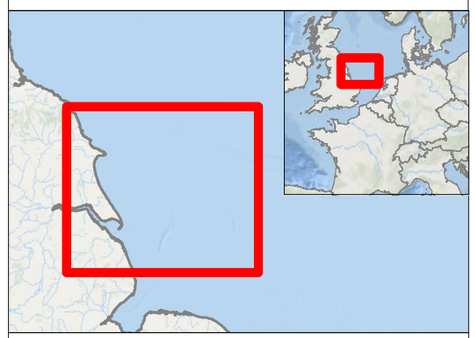
Scoping Boundary

Array Area

Marine Conservation Zone (MCZ)

Holderness Inshore MCZ

Holderness Offshore rMCZ



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:500000

0 3 6 12 18 24 Kilometres

0 2 4 8 12 Nautical Miles

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Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Date: 02/10/2018 Author: LauraStally Name: H4SR_AN01_Marine Conservation Zone Assessment_A3Land_ETRS89

Location of Marine Conservation Zones (MCZ) and recommended MCZs
Document no: H4SR_AN02
Created by: LS
Checked by: CC
Approved by: LK

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Holderness Inshore MCZ

2.1.1.4 The Holderness Inshore MCZ is located at the landward end of the offshore ECC and was designated in January 2016. The site begins in Skipsea and extends along the coast south to the mouth of the Humber estuary. The MCZ has an area of approximately 309km^2 and overlaps, at its very northern extent, with the offshore ECC by approximately 0.64 km^2. The following information is taken from the Defra overview document for the site (Defra, 2016).

2.1.1.5 The seabed in this site is made up of rock, sand, mud and sediment. The mosaic of habitats within the site supports a diverse range of organisms including red algae, sponges and other encrusting fauna. The site also supports fish species such as European eel (*Anguilla anguilla*), dab (*Limanda limanda*) and wrasse, as well as commercially significant crustaceans such as edible crab (*Cancer pagurus*), the velvet swimming crab (*Necora puber*) and lobster (*Homarus gammarus*).

2.1.1.6 Partly above the water, the sandy beaches of intertidal sand and muddy sand are uncovered at low tide. These sandy shores may appear devoid of marine life, but are in fact home to many species, buried in the damp sand. On all but the most barren sandy shores, there will be different kinds of worms just beneath the surface. The strandline of seaweed and other debris left behind at the top of the shore by the falling tide is also home to creatures including shrimp-like sandhoppers. Muddier sands support bivalves (with their paired, hinged shells), including the common cockle (*Cerastoderma edule*), and sea snails like the laver spire shell.

2.1.1.7 The site also protects a geological feature, Spurn Head, which is at the southern extent of the MCZ. This is a unique example of an active spit system, extending across the mouth of the Humber Estuary.

Holderness Offshore rMCZ

2.1.1.8 The Holderness Offshore rMCZ is located approximately 11 km offshore from the Holderness coast covering an area of approximately 1,176 km^2 and overlaps, at its very northern extent, with the offshore ECC by approximately 1.04 km^2. It was brought forward for consultation on the 8th June 2018 with consultation closing on 20th July 2018. The following information is taken from the Defra overview document for the site (Defra, 2018).

2.1.1.9 The Holderness Offshore seabed is predominantly composed of sediment habitats ranging from subtidal sand to subtidal coarse sediments and contains part of a glacial tunnel valley. The varied nature of the seabed means it supports a wide range of animals, both on and in the sediment, such as worms, bivalves, starfish and crustaceans. The site is also a spawning and nursery ground for a number of fish species including lemon sole (*Microstomus kittus*), plaice (*Pleuronectes platessa*) and European sprat (*Sprattus sprattus*).

2.1.1.10 Surveys have also identified ocean quahog (*Arctica islandica*) within the site. This bivalve mollusc is particularly slow growing and can take up to 50 years to reach full size, growing

up to 13 cm in width. Ocean quahogs are listed by the Oslo and Paris Convention for the Protection of the North East Atlantic (OSPAR1) as a threatened and/or declining species.

Table 1 - Sites proposed to be screened into the Hornsea Four MCZ assessment, their designated features and conservation objectives/general management approach.

Site name	Protected features/proposed protection features	Type of feature	General management approach
Holderness Inshore MCZ	Intertidal sand and muddy sand	Broadscale marine habitat	Maintain in favourable condition
	Moderate energy circalittoral rock		
	High energy circalittoral rock		
	Subtidal coarse sediment		
	Subtidal mixed sediments		
	Subtidal sand		
	Subtidal mud		
	Spurn head (subtidal)	Geological feature	
Holderness Offshore rMCZ	North Sea Glacial Tunnel valleys	Geological/Geomorphological feature	Maintain in favourable condition
	Subtidal coarse sediment	Broadscale marine habitat	Recover to favourable condition
	Subtidal sand		
	Subtidal mixed sediments		
	Ocean Quahog (*Artica islandica*)	Marine species	

2.2 Proposed Approach

2.2.1.1 On the basis that the features for which MCZs are designated/recommended for designation are almost exclusively benthic habitats and species, it is proposed that the most appropriate approach would be to have a standalone MCZ assessment as a stand-alone Technical Appendix to the PEIR (and subsequently the final Environmental Statement (ES)) (noting that it is currently proposed to scope benthic and intertidal ecology out of the EIA process).

2.2.1.2 The following sections outline the proposed approach to the Hornsea Four MCZ assessment.

2.2.1 Screening

2.2.1.1 Initially, a full screening exercise will be undertaken in order to confirm the designated MCZs which are to be carried forward for consideration in the Stage 1 assessment (and building on the preliminary screening assessment presented above).

It should be noted that although the scoping boundary for the offshore ECC intersects the rMCZ and the MCZ, Ørsted have committed to the final routing of the export cables to avoid crossing any portion of either sites as set out in Commitments Co44 andCco45 (for Holderness Inshore and Holderness Offshore MCZs respectively) within the Commitments Register (Annex B of the Scoping Report).

2.2.1.2 The full screening exercise will consider the proximity of Hornsea Four to the proposed or designated MCZs, along with the likelihood that Hornsea Four could impact on the protected features within the site and the processes upon which they depend.

2.2.1.3 According to the MMO (2013) guidance, Section 126 of the MCAA will apply if:

- The licensable activity is taking place within or near an area being put forward or already designated as an MCZ; and
- The activity is capable of affecting (other than insignificantly) either (i) the protected features of an MCZ; or (ii) any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependant.

2.2.1.4 It is proposed that, in order to determine the 'nearness' of the activities associated with Hornsea Four, the same screening criteria are used for the MCZ assessment as is proposed for the Habitats Regulations Assessment (HRA) screening. The criteria are based on the evidence from Hornsea Project One, Hornsea Project Two and Hornsea Three which predicted a precautionary suspended sediment dispersal of up to 2 mg/l extending up to 16 km from the array area and offshore ECC (e.g. SMart Wind, 2015). This distance criteria will therefore be used during the screening of MCZs around the Hornsea Four array area (**Figure 1**).

2.2.1.5 In determining 'insignificance', the MMO (2013) guidance states that this should take into account the likelihood of an activity causing an effect, the magnitude of the effect should it occur, and the potential risk any such effect may have on either the protected features of an MCZ or any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependant. It is proposed that this will be determined for Hornsea Four through a specific MCZ assessment (noting that it is proposed to scope out, in full, any consideration of impacts on benthic ecology from the further EIA process).

2.2.2 Stage 1 Assessment

2.2.2.1 The Stage 1 Assessment which will be presented in the PEIR, will consider the extent of the potential impact of Hornsea Four, on the MCZ and rMCZ screened in to the assessment, in more detail.

2.2.2.2 At this stage the conservation objectives for the MCZ features will need to be considered. The conservation objectives for MCZ features are high level criteria describing the desired condition of the MCZ features. There are two objectives for features within an MCZ:

- Whether the features are in the desired favourable condition and need to be maintained in this condition; or
- Whether the features are not in the desired favourable condition and need to be recovered to that condition.

2.2.2.3 The Hornsea Four Stage 1 MCZ assessment will therefore consider whether Hornsea Four could potentially affect these objectives for the MCZ and rMCZ screened into the assessment. An assessment will be presented considering whether Hornsea Four could potentially impact the site so that the features are no longer in favourable condition or prevent the features from recovering to a favourable condition.

2.2.2.4 The Stage 1 MCZ Assessment will also consider whether Hornsea Four will interfere with the MMO's ability to exercise its function to further the conservation objectives of MCZs.

2.2.2.5 It is anticipated that the MMO will use information supplied by the applicant with the DCO application, advice from the Statutory Nature Conservation Bodies (SNCBs) and any other relevant information to determine whether (as set out in MMO guidance):

- There is no significant risk of the activity hindering the achievement of the conservation objectives stated for the MCZ; and
- The MMO can exercise its functions to further the conservation objectives stated for the MCZ.

2.2.2.6 If neither of the criteria above can be met, the Stage 1 assessment will then need to consider whether:

- There is no other means of proceeding with the act which would create a substantially lower risk of hindering the achievement of the conservation objectives stated for the MCZ. This could include proceeding with it (a) in another manner, or (b) at another location.

2.2.2.7 If mitigation to reduce the impacts to an acceptable level cannot be secured, and there are no other means of proceeding, then a Stage 2 assessment will be required.

2.2.3 Stage 2 Assessment

2.2.3.1 The Stage 2 MCZ Assessment considers the socio-economic impact of the plan or project together with the risk of environmental damage. There are two parts to the Stage 2 assessment process:

- Does the public benefit in proceeding with the project clearly outweigh the risk of damage to the environment that will be created by proceeding with it? If so;
- Can the applicant satisfy that they can secure, or undertake arrangements to secure, measures of equivalent environmental benefit for the damage the project will have on the MCZ features?

2.2.3.2 Guidance from the MMO on what constitutes measures of equivalent environmental benefit states that measures can be based on those considered appropriate when securing compensatory habitat for projects deemed to have an adverse effect on internationally designated sites under the Habitats Directive, although consideration will not be confined to those.

3 References

Department for Environment, Food and Rural Affairs (Defra) (2016). Holderness Inshore Marine Conservation Zone: Factsheet. 17 January 2016.

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SMart Wind (2015) Hornsea Project Three Offshore Wind Farm Environmental Statement: Volume 2, Chapter 1 – Marine Process. PINS Document Reference: A6.2.1.

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Environmental Impact Assessment: Scoping Report

Annex G Indicative Water Crossings Schedule

Watercourse Category	Watercourse Name	OS Grid Ref	Proposed Crossing Method	Notes	Flood Defence
IDB Maintained	The Earls Dike	TA1661861386	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
Ordinary Watercourse	Unnamed	TA1649961249	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA1493159439	Open Cut	Minor ditch along field boundary	n/a
IDB Maintained	Burton Drain	TA1456359079	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
IDB Maintained	Dringhoe Drain	TA1378756728	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
Ordinary Watercourse	Unnamed	TA1764455501	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA1760655538	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA1714455813	HDD	Highway drain adjacent to Mill Lane. HDD with road.	n/a
Ordinary Watercourse	Sewer Dike	TA1679555994	Open Cut	Minor ditch along field boundary	n/a

Watercourse Category	Watercourse Name	OS Grid Ref	Proposed Crossing Method	Notes	Flood Defence
IDB Maintained	Skipsea Drain	TA1565856143	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
Ordinary Watercourse	Unnamed	TA1553556106	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA1493256102	HDD?	Highway drain adjacent to access road. HDD if road is to be HDD'ed	n/a
IDB Maintained	Dringhoe Drain	TA1382256209	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
Ordinary Watercourse	Unnamed	TA1200156519	Open Cut	Minor ditch along field boundary	n/a
IDB Maintained	Barnston Sea End	TA1182556603	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
Ordinary Watercourse	Unnamed	TA1155856674	HDD	Highway drain adjacent to Out Gates access road. HDD with road. Suggest moving crossing to avoid crossing watercourse twice.	n/a

Watercourse Category	Watercourse Name	OS Grid Ref	Proposed Crossing Method	Notes	Flood Defence
Ordinary Watercourse	Unnamed	TA1090256600	HDD	Highway drain adjacent to Out Gates access road. HDD with road.	n/a
Ordinary Watercourse	Unnamed	TA0971856018	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA0940455743	Open Cut	Minor ditch along field boundary	n/a
Main River	Foston Beck	TA0911155485	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Left Bank: High Ground Right Bank: Embankment
Ordinary Watercourse	Unnamed	TA0895855352	HDD	Highway drain adjacent to Carr House Farm access road. HDD if road is to be HDD'ed.	n/a
Main River	Creyke Dike	TA0866355218	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Left Bank: High Ground Right Bank: High Ground
IDB Maintained	Nafferton Lowlands Drain	TA0840355156	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
IDB Maintained	Nafferton Lowlands Drain	TA0770454304	HDD	Project commitment to use trenchless methods on all	n/a

Watercourse Category	Watercourse Name	OS Grid Ref	Proposed Crossing Method	Notes	Flood Defence
				EA Main Rivers and IDB Maintained watercourses.	
Ordinary Watercourse	Unnamed	TA0763454243	Open Cut	Minor ditch along field boundary	n/a
Main River	West Beck	TA0749054208	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Left Bank: High Ground Right Bank: High Ground
Ordinary Watercourse	Unnamed	TA0684253741	Open Cut	Minor ditch along field boundary	n/a
IDB Maintained	Nafferton Lowlands drain	TA0650152923	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Right Bank: Embankment. Runs adjacent to main river
Main River	River Hull	TA0648852893	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Left Bank: Embankment Right Bank: Embankment. Runs adjacent to ordinary watercourse (on left side)
Ordinary Watercourse	Unnamed	TA0609251958	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA0589251538	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Rotsea Drain	TA0575051167	Open Cut	Minor ditch along field boundary	n/a

Watercourse Category	Watercourse Name	OS Grid Ref	Proposed Crossing Method	Notes	Flood Defence
Main River	Scurf Dike	TA0561150622	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Left Bank: Embankment Right Bank: Embankment.
Ordinary Watercourse	Spring Dike	TA0490649690	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA0443148973	HDD	Highway drain adjacent to Carr Lane. HDD with road.	n/a
Ordinary Watercourse	Unnamed	TA0442648962	HDD	Highway drain adjacent to Carr Lane. HDD with road.	n/a
Main River	Watton Beck	TA0434148811	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Left Bank: Embankment Right Bank: Embankment.
Ordinary Watercourse	Unnamed	TA0416748521	Open Cut	Minor ditch along field boundary	n/a
IDB Maintained	Kilnwick Arm	TA0401048382	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a
IDB Maintained	Beswick New Cut	TA0376448008	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	n/a

Watercourse Category	Watercourse Name	OS Grid Ref	Proposed Crossing Method	Notes	Flood Defence
Ordinary Watercourse	Unnamed	TA0362647783	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA0312447528	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA0182747095	Open Cut	Minor ditch along field boundary	n/a
Main River	Bryan Mills Beck	TA0101246265	HDD	Project commitment to use trenchless methods on all EA Main Rivers and IDB Maintained watercourses.	Left Bank: High ground Right Bank: High ground
Ordinary Watercourse	Unnamed	TA0091246030	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Bealeys Beck	TA0042245455	HDD	Appears to be natural channel with sinuous plan form upstream.	n/a
Ordinary Watercourse	North Drain	TA0056442927	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA0053642276	HDD	Water course culverted under old railway embankment.	n/a
Ordinary Watercourse	Unnamed	TA0061838229	Open Cut	Minor ditch along field boundary	n/a
Ordinary Watercourse	Aurtherd Drain	TA0109037316	HDD?	Water course with large woodland coverage and	n/a

Watercourse Category	Watercourse Name	OS Grid Ref	Proposed Crossing Method	Notes	Flood Defence
				disused sewage works plant.	
Ordinary Watercourse	Unnamed	TA0428148671	HDD?	Tributary of EA Main River and woodland cover.	n/a
Ordinary Watercourse	Unnamed	TA0477449548	Open Cut	Minor ditch Along Field Boundary	n/a
Ordinary Watercourse	Unnamed	TA0513649756	HDD	Highway drain adjacent to Throstle Nest Farm. HDD with road.	n/a
Ordinary Watercourse	Unnamed	TA1155156673	HDD	Highway drain adjacent to Out Gates access road. HDD with road. Suggest Moving Dig to avoid twice.	n/a
Ordinary Watercourse	Unnamed	TA1275756495	Open Cut	Minor Ditch along field boundary	n/a
Ordinary Watercourse	Unnamed	TA1275856389	Open Cut	Minor Ditch along field boundary	n/a

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Annex H Phase 1 Ecology Map Book

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GRID NORTH

Sources: Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Name: H4SR_Annex_H_Phase1HabitatArea_A3Por_BNG

Date: 08/10/2018

Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Ground Truthing Locations
- Phase I Habitat Survey Area

Coordinate system: British National Grid
Vertical reference: LAT
Scale @ A3: 1:105000

0 1 2 3 4 Kilometres

0 1 2 3 4 Miles

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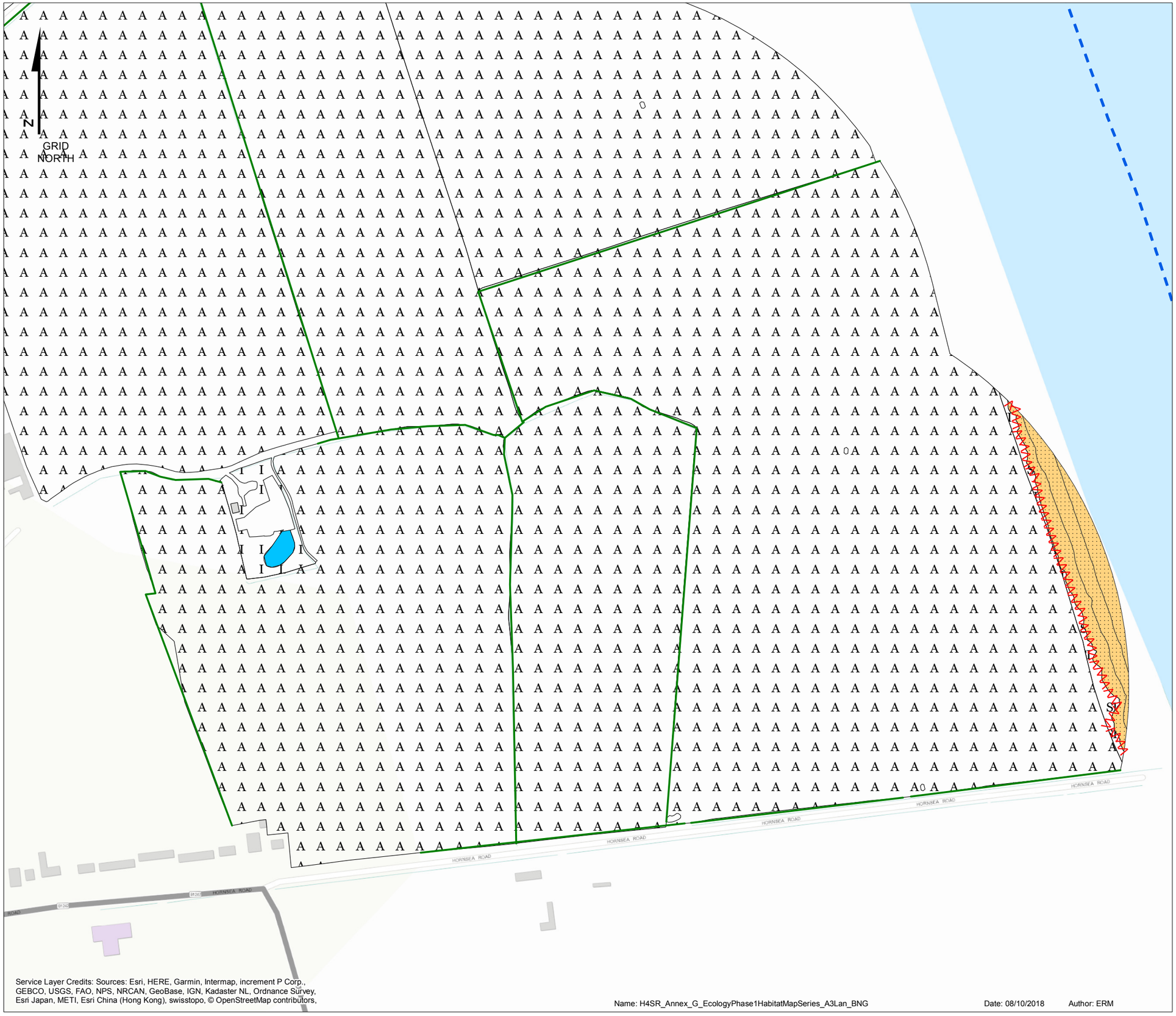


Scoping Boundary

Scoping Boundary Component

H8.2 - Soft cliff

J2.1.2 - Intact hedge - species-poor

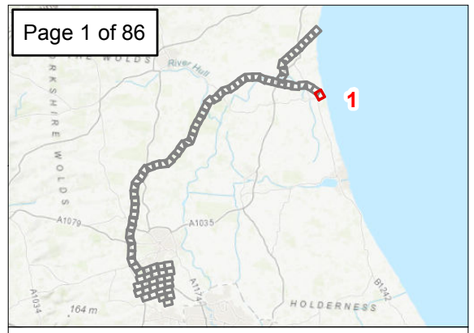
B4 - Improved grassland

B6 - Poor semi-improved grassland

G1 - Standing water

H1.1 - Intertidal - mud/sand

J1.1 - Cultivated/disturbed land - arable



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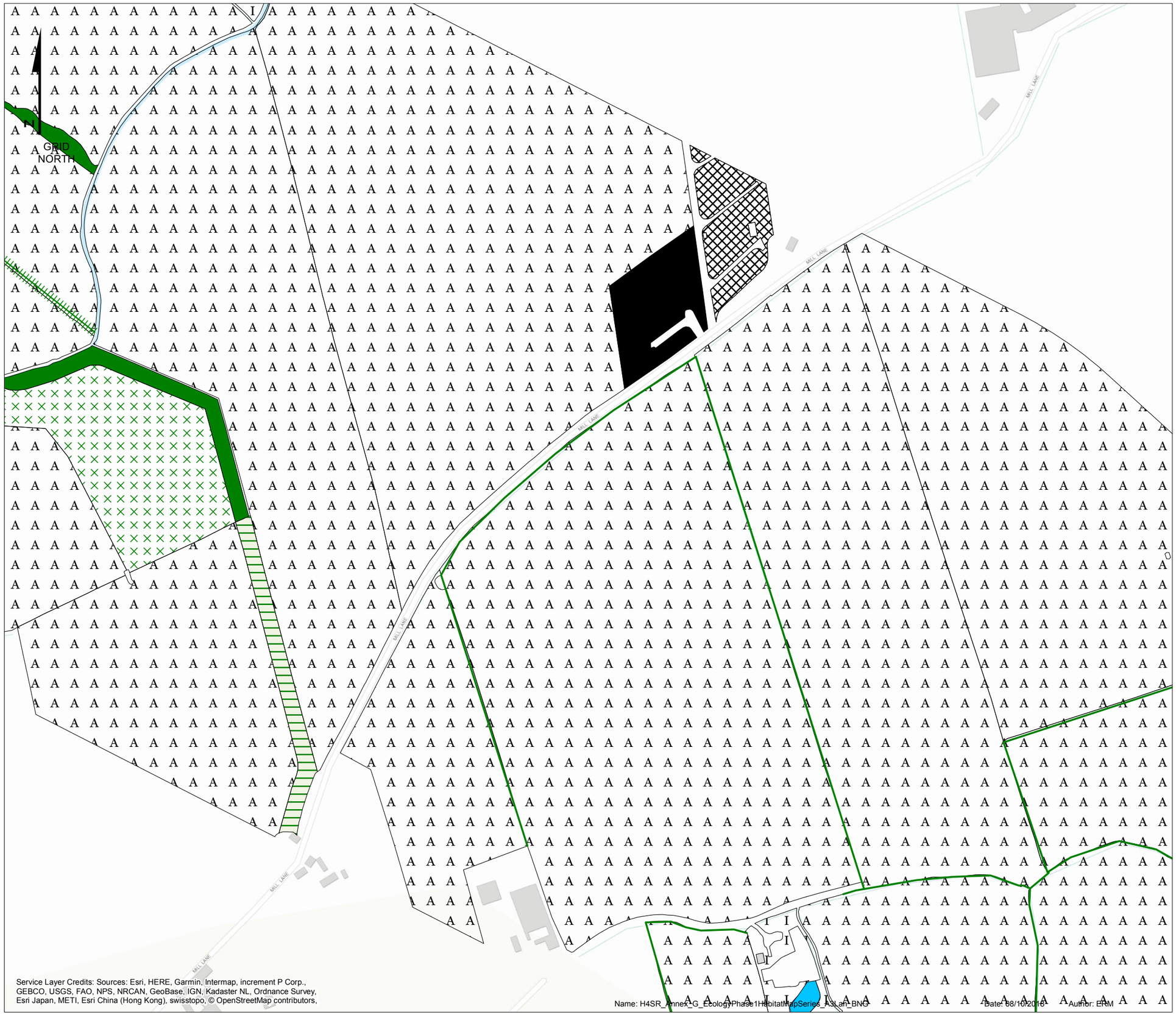
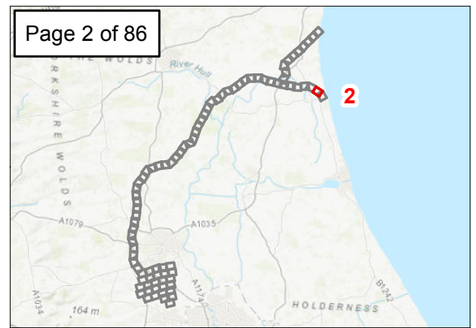


Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A2.2 - Scrub - scattered
B4 - Improved grassland
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J2.1.2 - Intact hedge - species-poor
J3.4 - Caravan site
J3.6 - Buildings



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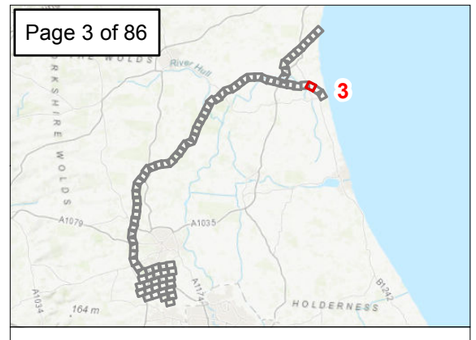
- Scoping Boundary
- Scoping Boundary Component
- SSSI Areas (Natural England)
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.3.1 - Mixed woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B2.2 - Neutral grassland - semi-improved
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



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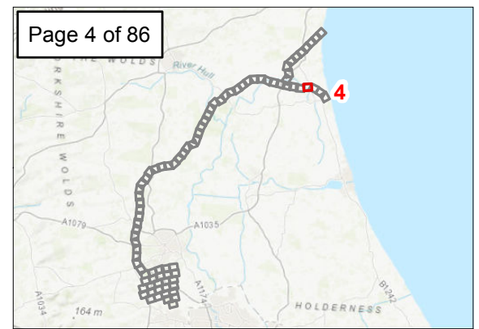
Skipsea Bail Mere Site of Special Scientific Interest

- Scoping Boundary
- Scoping Boundary Component
- SSSI Areas (Natural England)
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.3.1 - Mixed woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B2.2 - Neutral grassland - semi-improved
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



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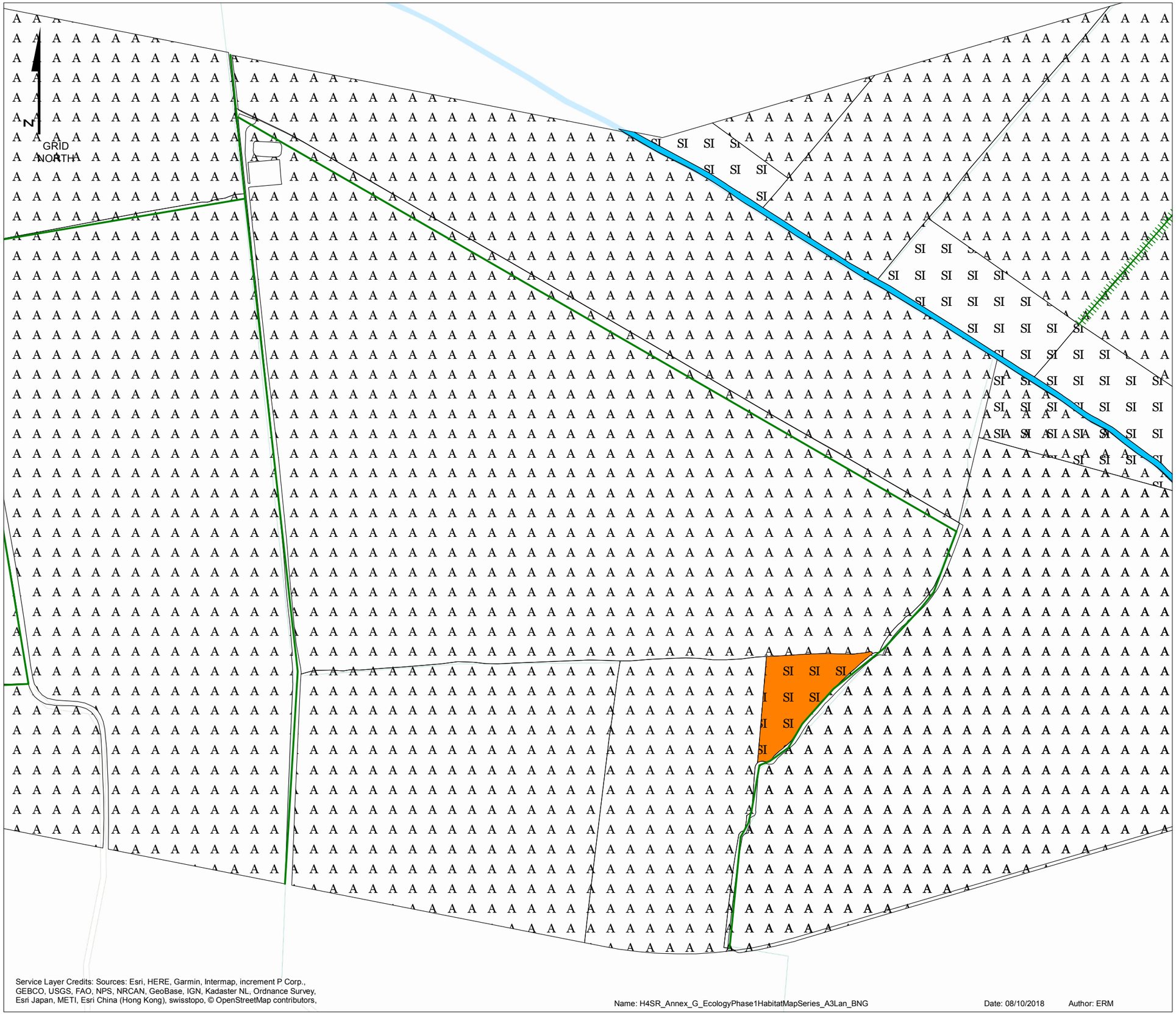
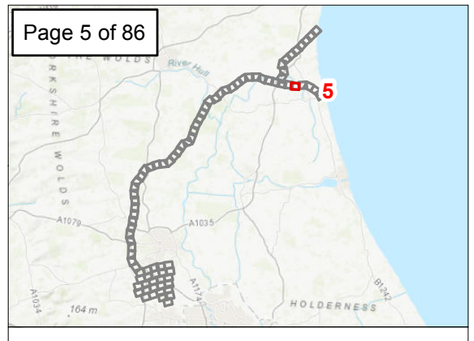


Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
B2.2 - Neutral grassland - semi-improved
B6 - Poor semi-improved grassland
G2 - Running water
J1.1 - Cultivated/disturbed land - arable



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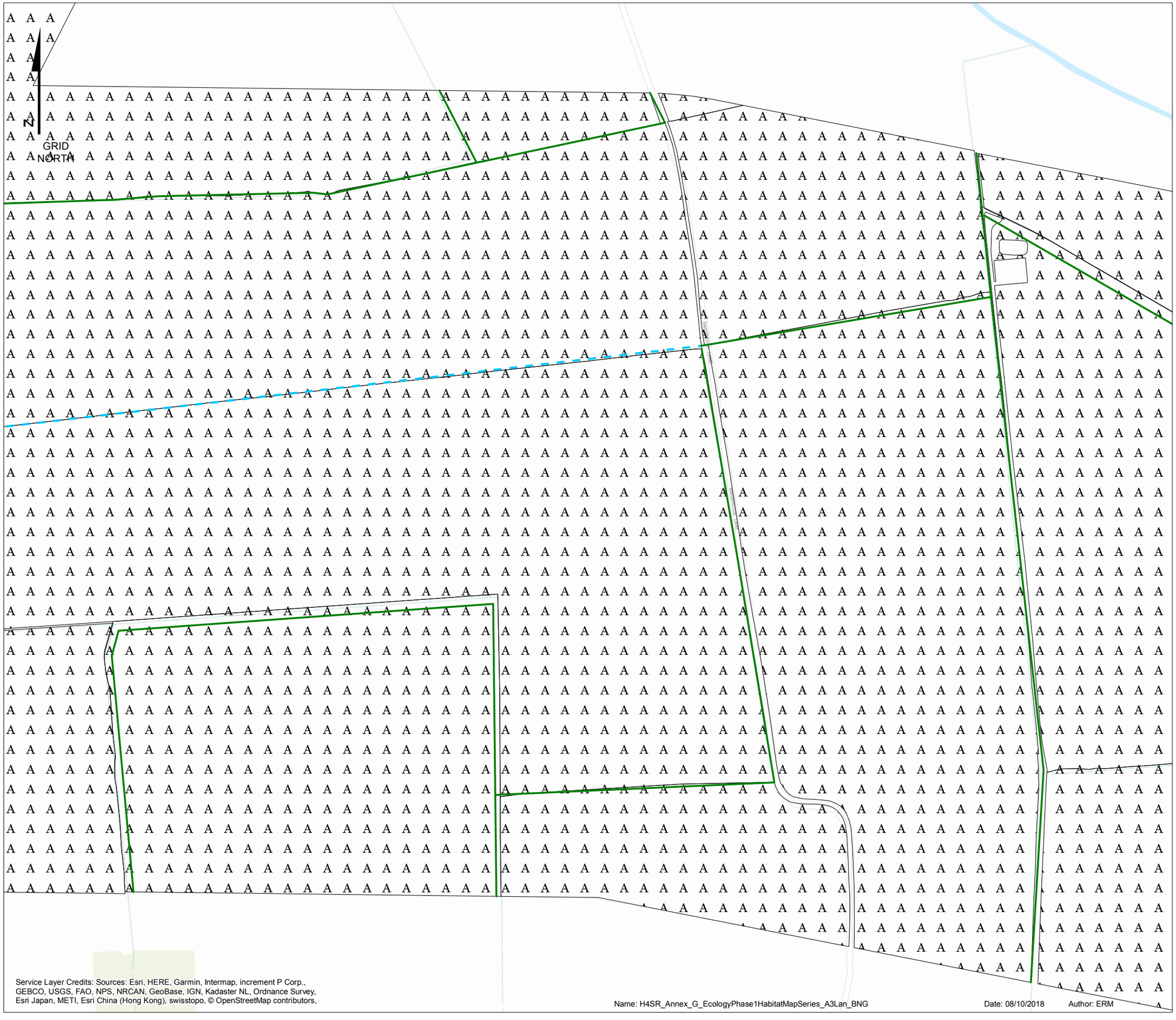


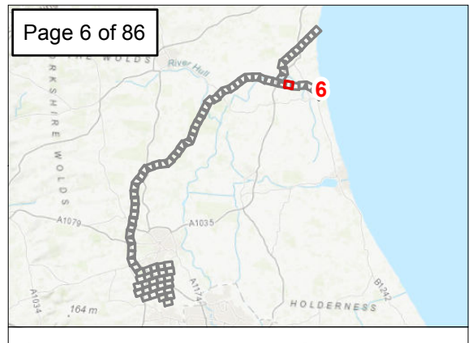
Scoping Boundary

Scoping Boundary Component

J2.1.2 - Intact hedge - species-poor

J2.6 - Dry ditch

J1.1 - Cultivated/disturbed land - arable



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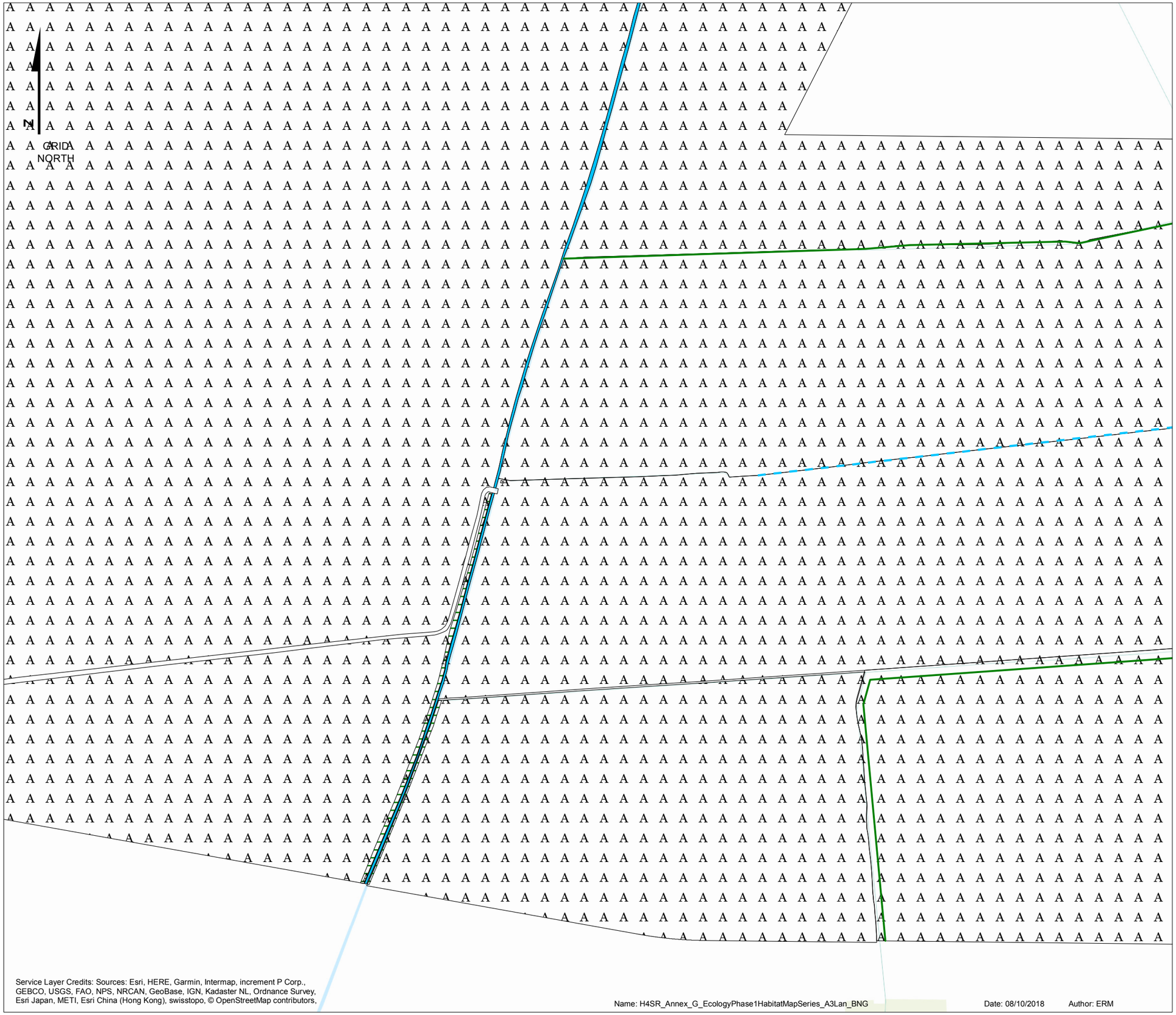


Scoping Boundary

Scoping Boundary Component

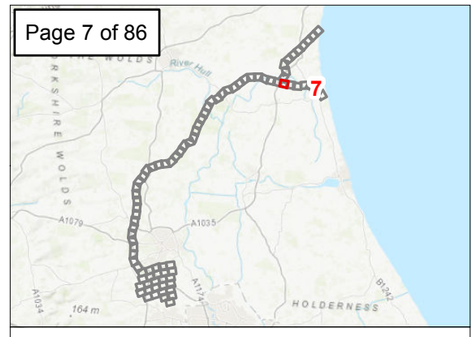
J2.1.2 - Intact hedge - species-poor

J2.6 - Dry ditch

G1 - Standing water

A J1.1 - Cultivated/disturbed land - arable

J2.1.2 - Intact hedge - species-poor



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GRID NORTH

Scoping Boundary

Scoping Boundary Component

J2.1.2 - Intact hedge - species-poor

J2.3.2 - Hedge with trees - species-poor

A1.1.1 - Broadleaved woodland - semi-natural

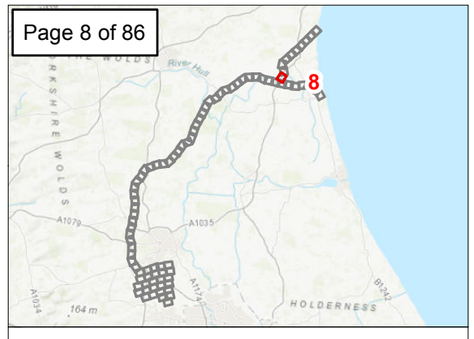
B4 - Improved grassland

G1 - Standing water

G2 - Running water

J1.1 - Cultivated/disturbed land - arable

J2.1.2 - Intact hedge - species-poor



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Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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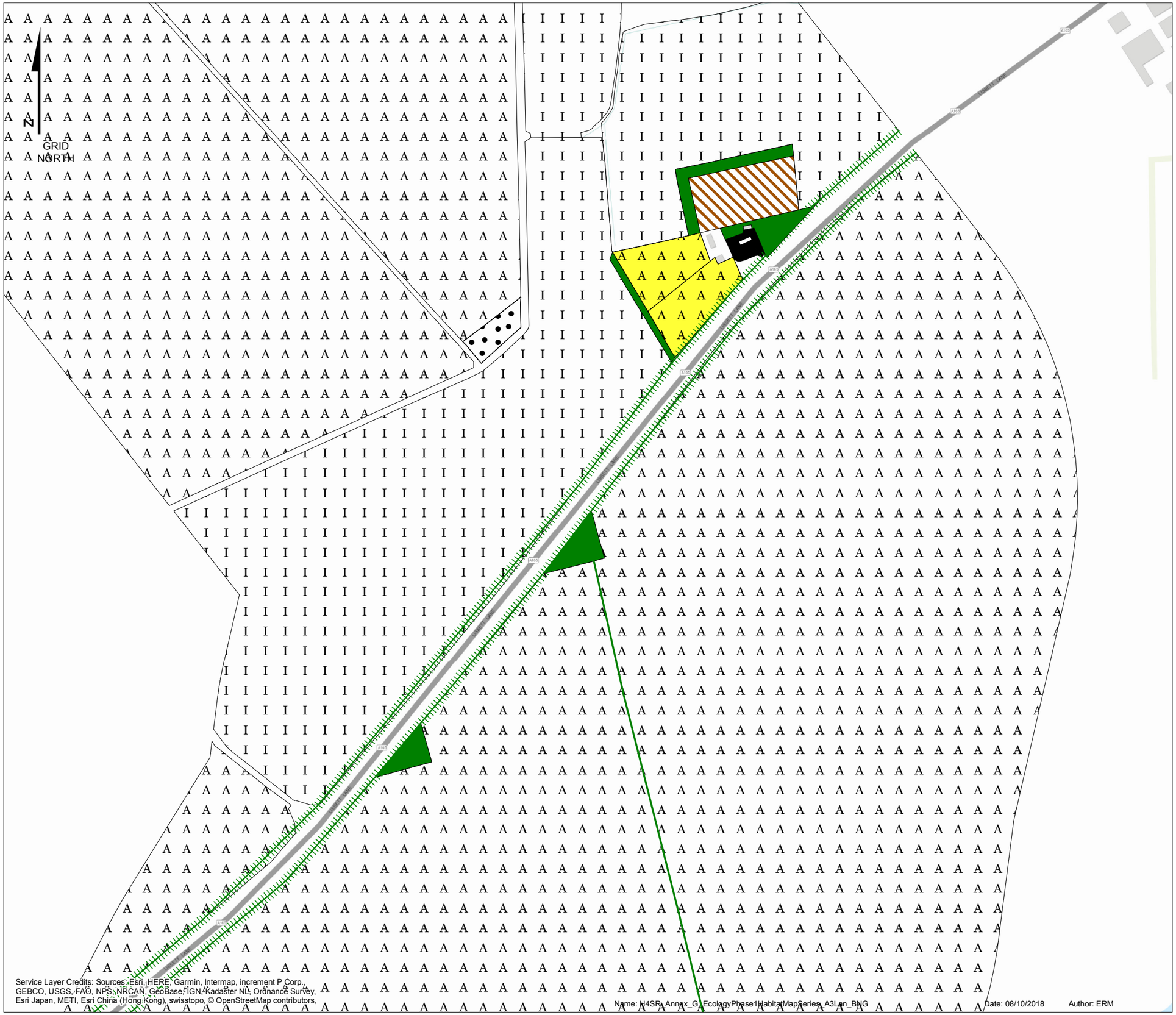

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
B4 - Improved grassland
C3.1 - Other tall herb and fern - ruderal
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J3.6 - Buildings
J4 - Bare ground

Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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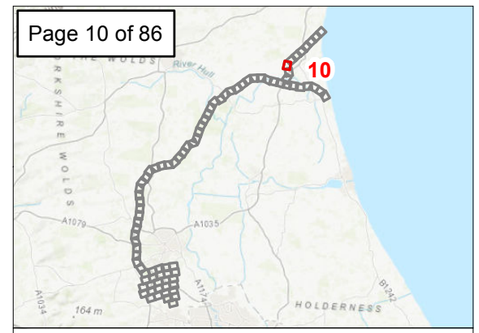
Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H

N

GRID
NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
B4 - Improved grassland
C3.1 - Other tall herb and fern - ruderal
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J3.6 - Buildings
J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat
Survey Map Series
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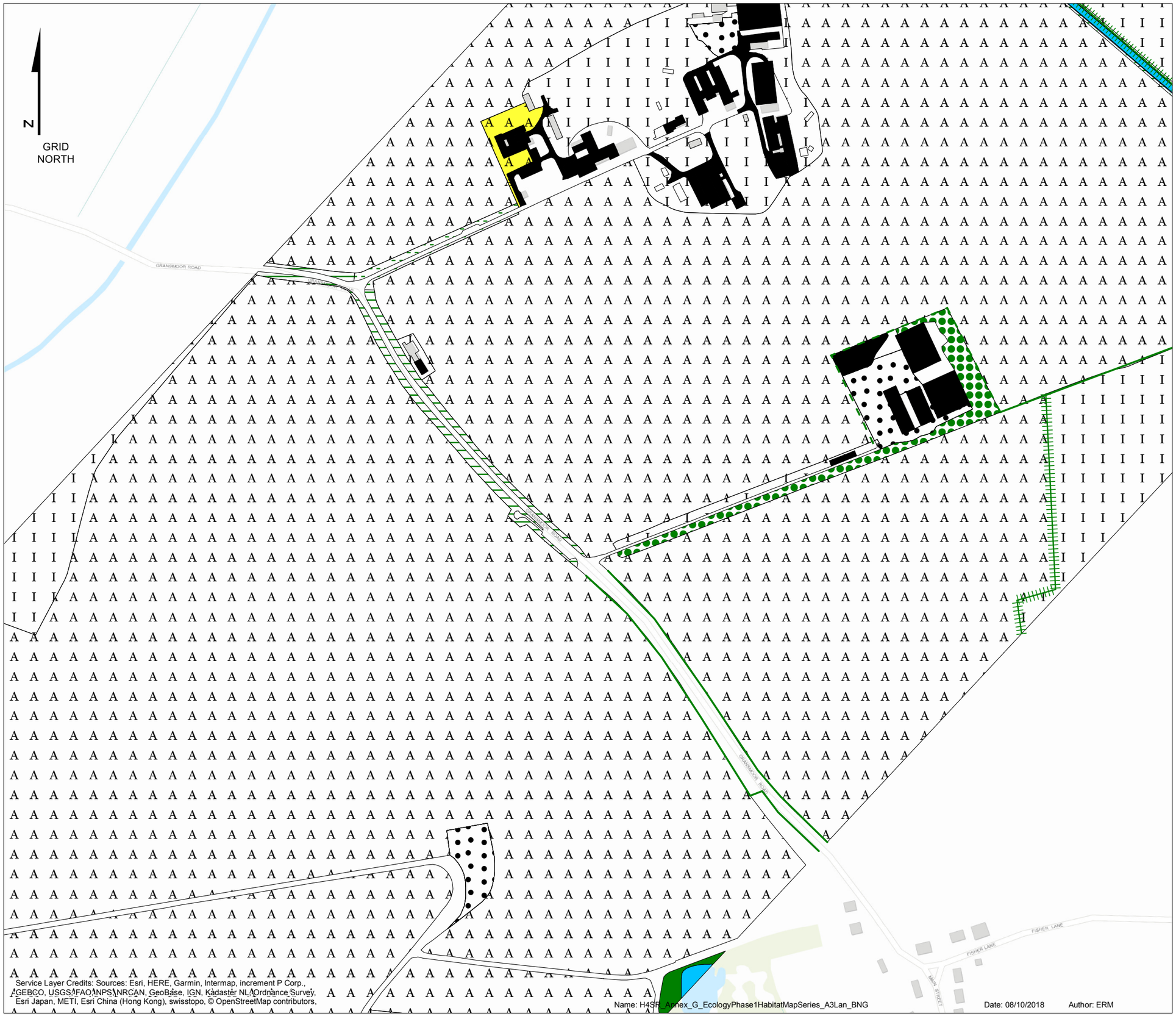
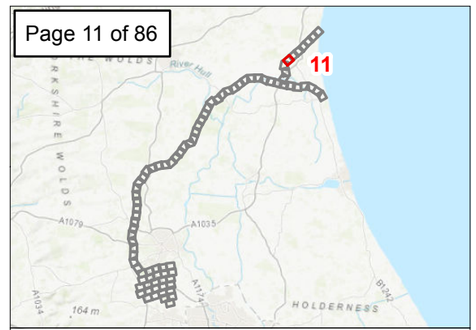
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J3.6 - Buildings
J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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Survey Map Series
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Hornsea Four
Phase 1 Habitat Survey
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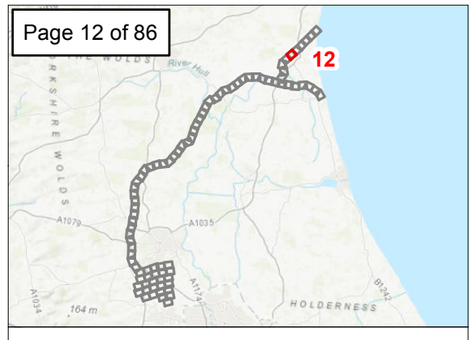
Annex H

N

GRID
NORTH

- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.2.2 - Defunct hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

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0 50 100 150 200 Yards

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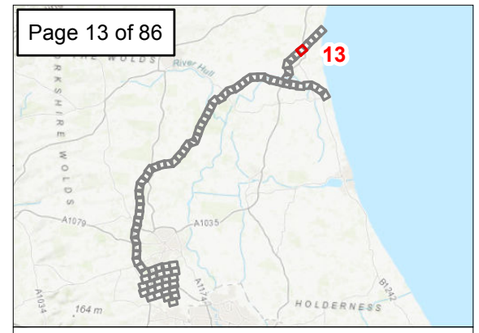
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.6 - Dry ditch
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- F1 - Swamp
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings



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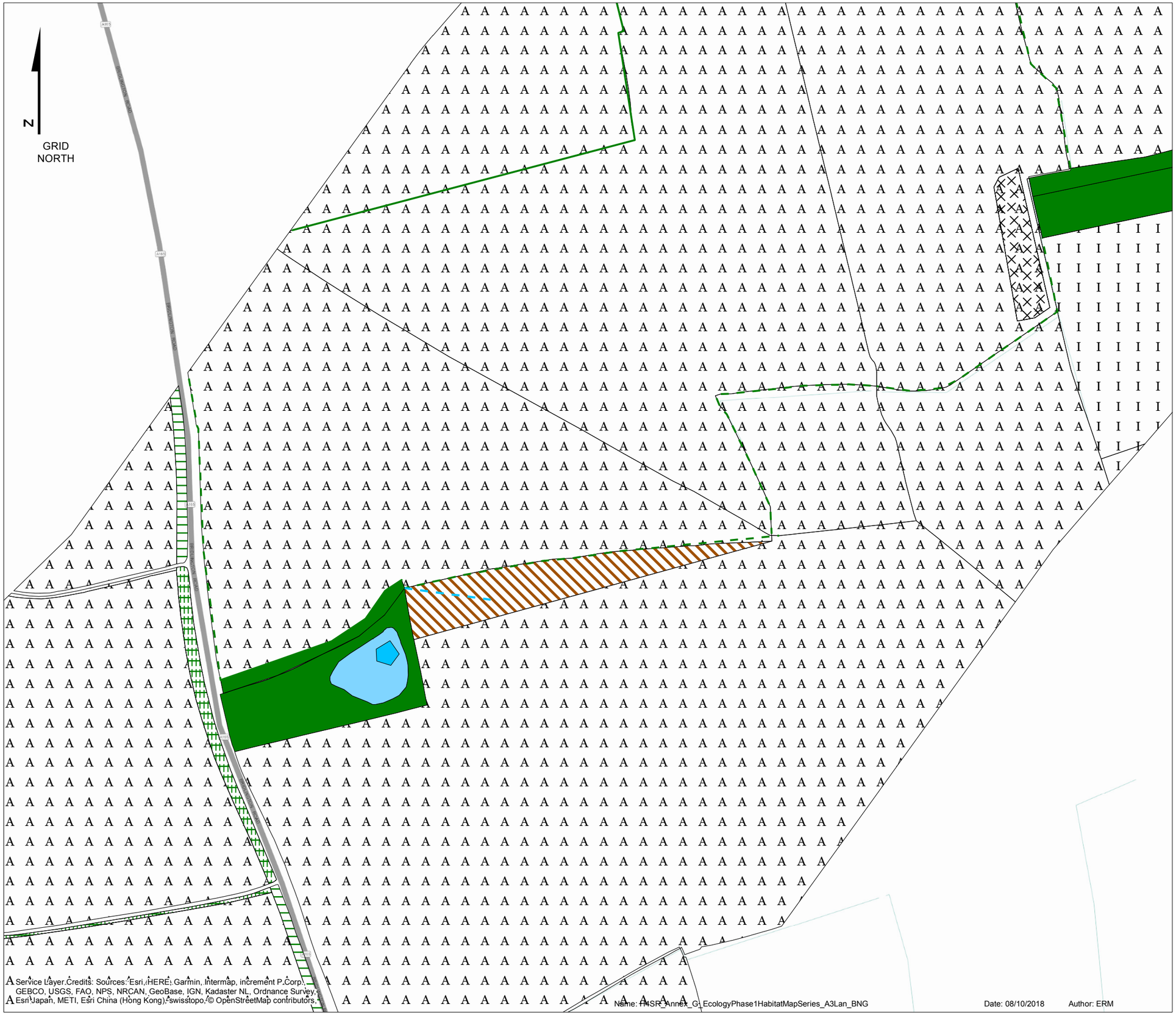
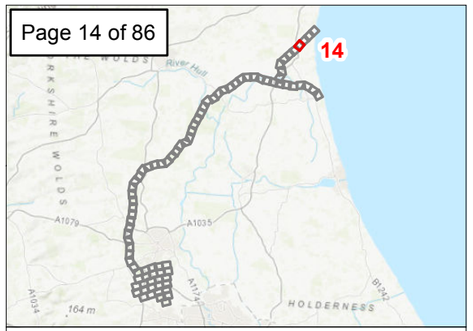
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.6 - Dry ditch
- A1.1.1 - Broadleaved woodland - semi-natural
- B4 - Improved grassland
- C3.1 - Other tall herb and fern - ruderal
- F1 - Swamp
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.3 - Cultivated/disturbed land - ephemeral/short perennial
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor



Coordinate system: British National Grid

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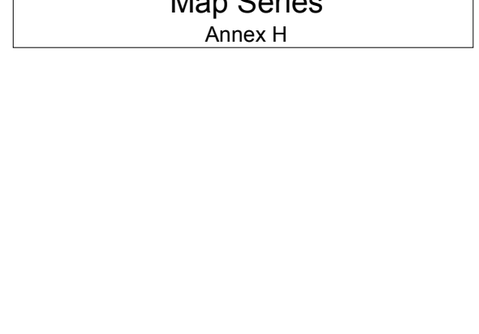
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
B4 - Improved grassland
B6 - Poor semi-improved grassland
J1.1 - Cultivated/disturbed land - arable
J1.3 - Cultivated/disturbed land - ephemeral/short perennial



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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Hornsea Four
Phase 1 Habitat Survey
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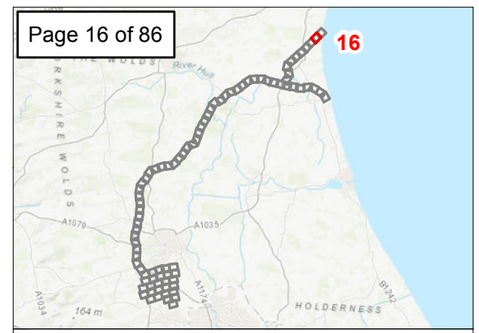
N

GRID
NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
B6 - Poor semi-improved grassland
F2.2 - Marginal and inundation - inundation vegetation
G1 - Standing water
G2 - Running water
H1.1 - Intertidal - mud/sand
J1.1 - Cultivated/disturbed land - arable



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0 50 100 150 200 Yards

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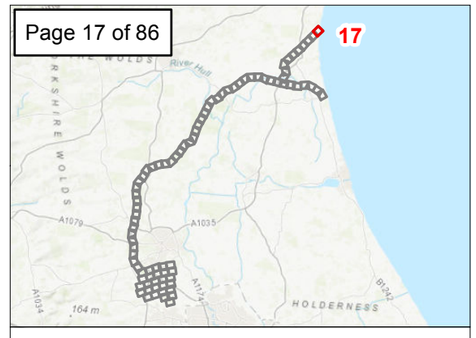
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

Scoping Boundary
Scoping Boundary Component
H8.2 - Soft cliff
J2.1.2 - Intact hedge - species-poor
F2.2 - Marginal and inundation - inundation vegetation
G2 - Running water
H1.1 - Intertidal - mud/sand
J1.1 - Cultivated/disturbed land - arable



Coordinate system: British National Grid

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0 50 100 150 200 Meters

0 50 100 150 200 Yards

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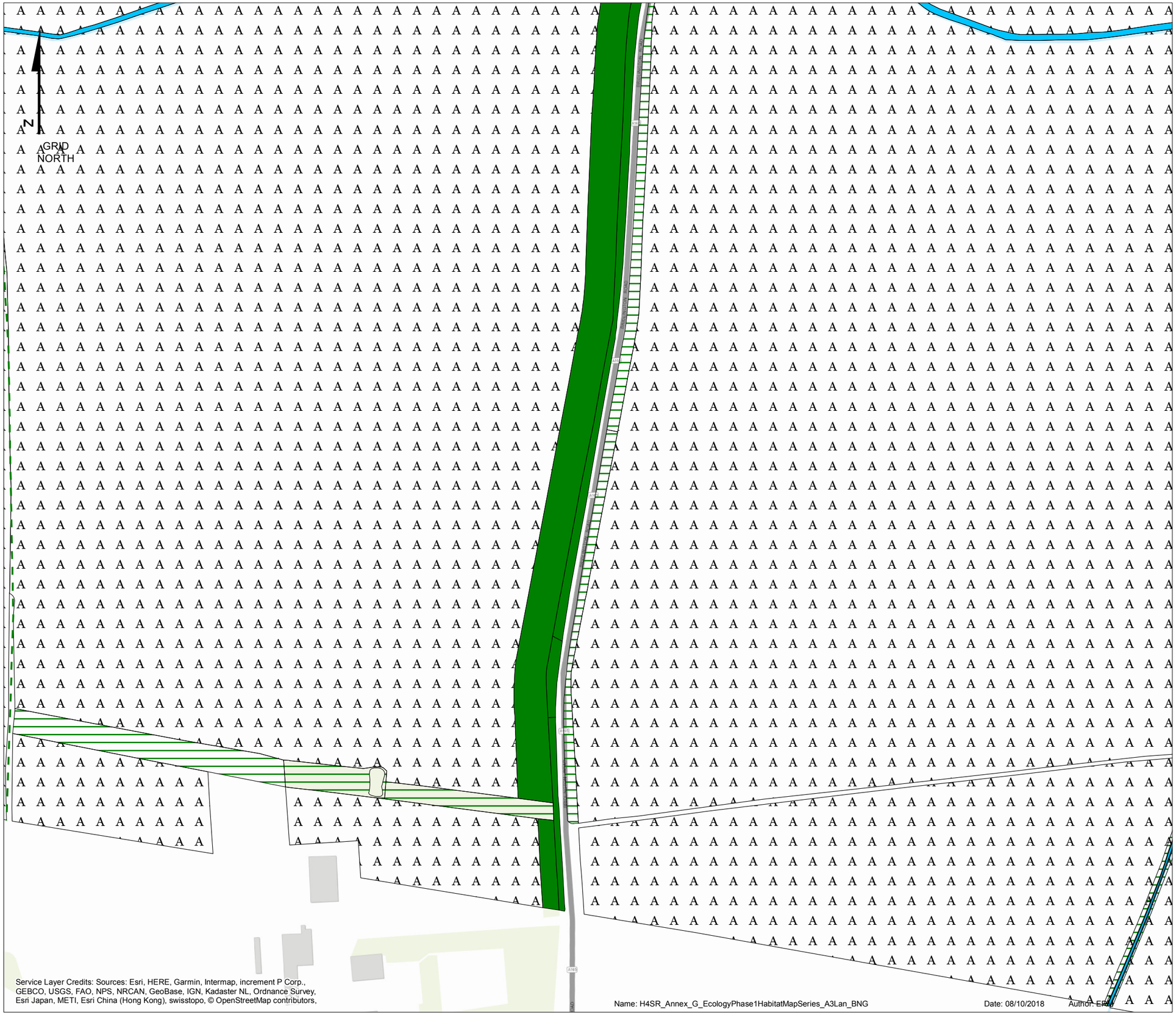
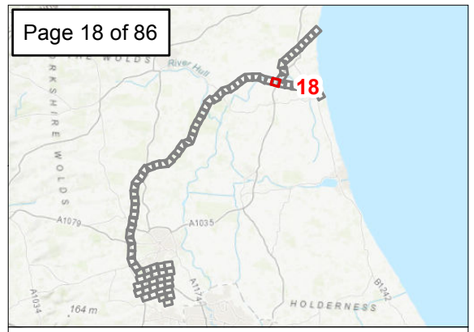
Date: 08/10/2018

Author: ERM

Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
J2.2.2 - Defunct hedge - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J2.1.2 - Intact hedge - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

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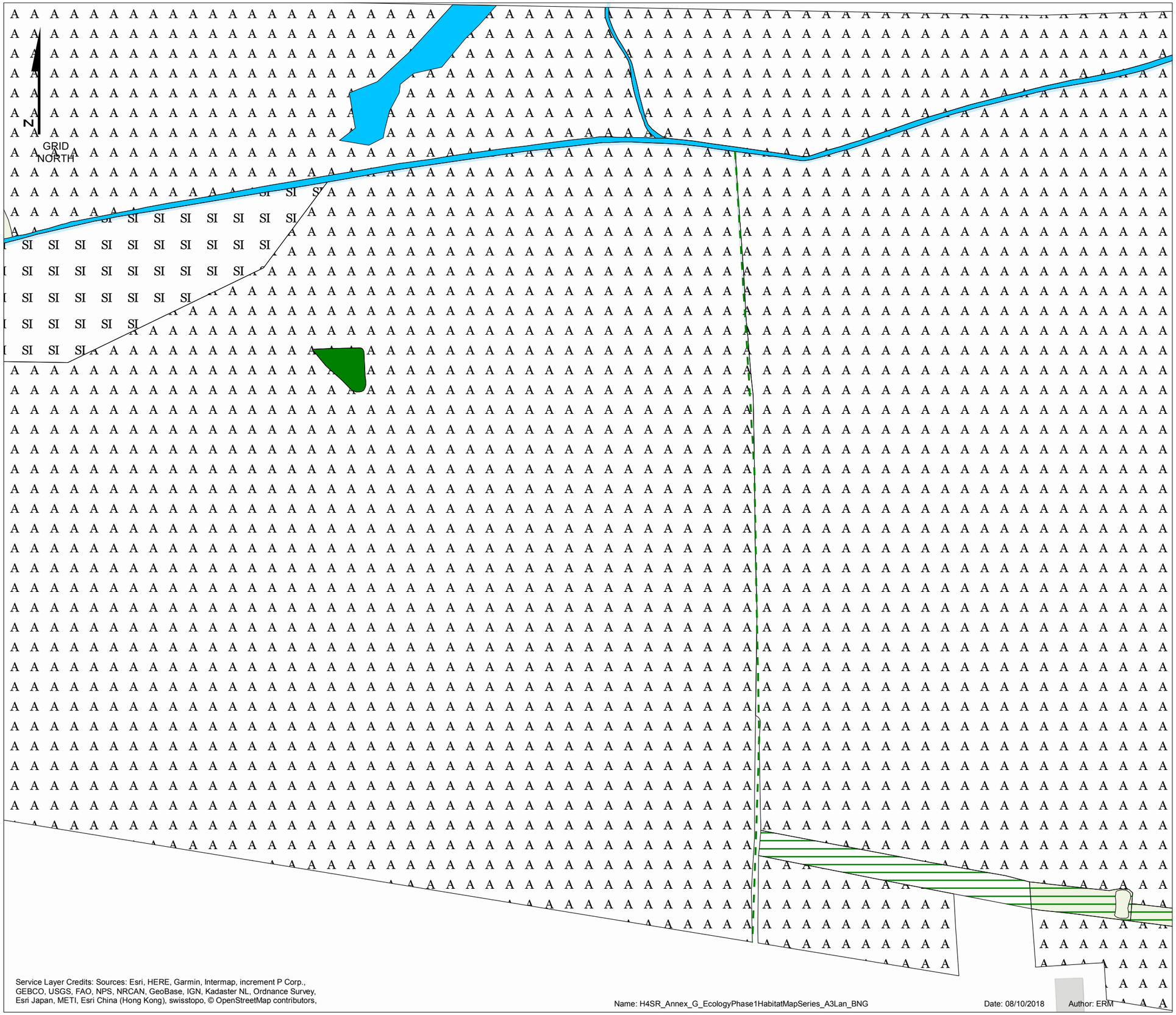
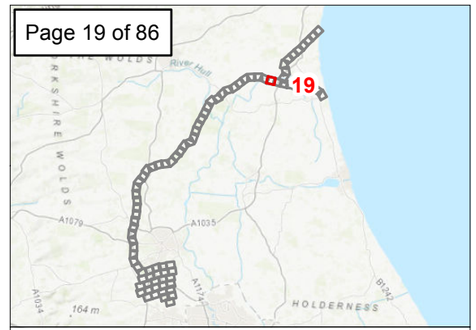
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.2.2 - Defunct hedge - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- SI B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- A J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor



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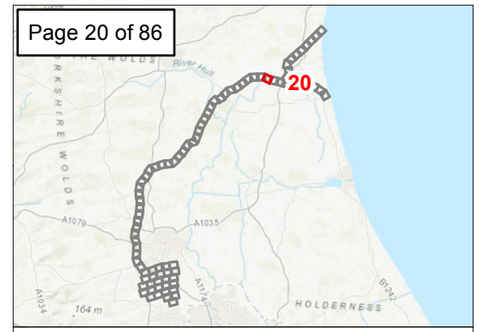
Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H

N
GRID NORTH

Scoping Boundary
Scoping Boundary Component
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B6 - Poor semi-improved grassland
C3.1 - Other tall herb and fern - ruderal
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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Survey Map Series
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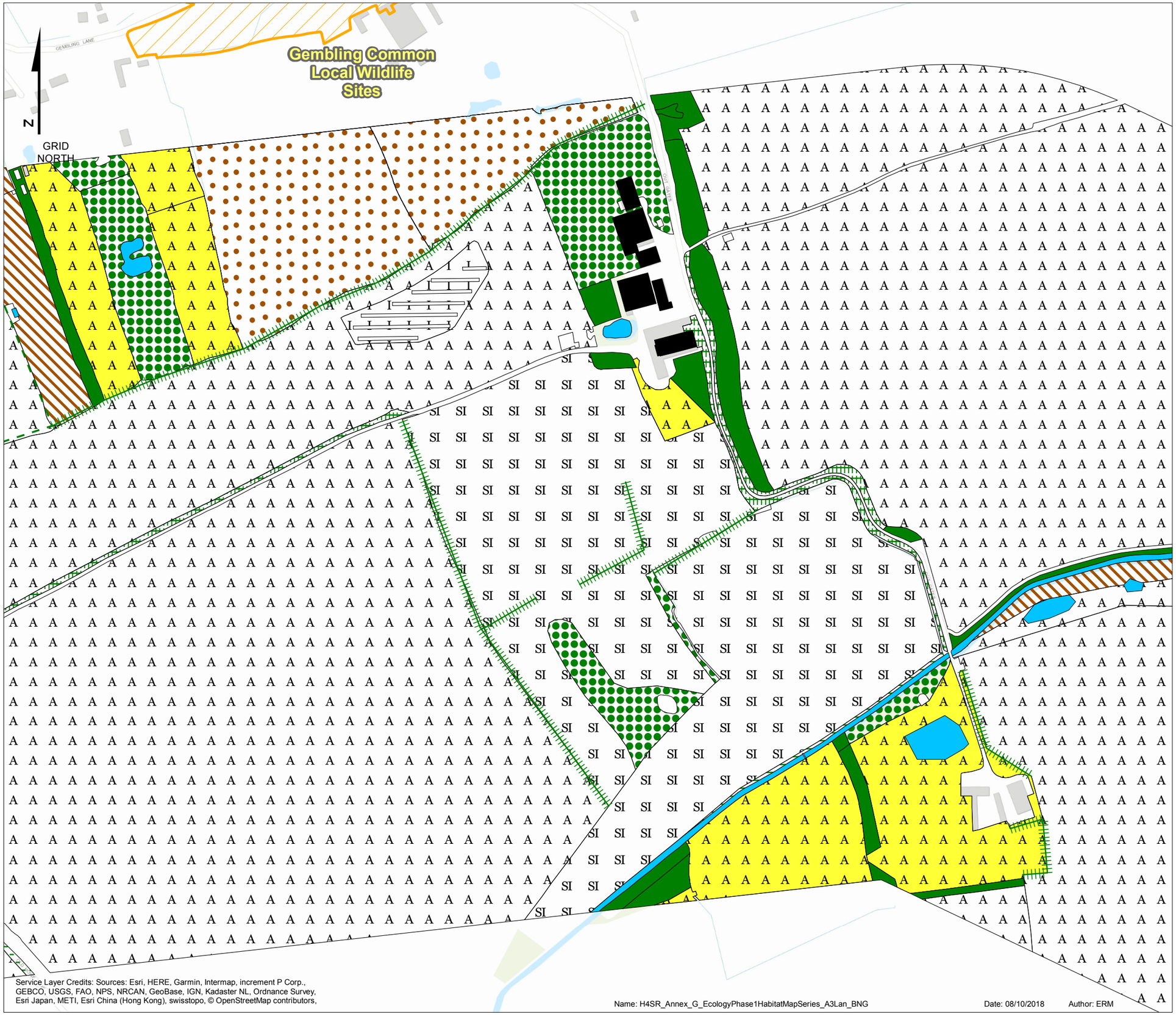
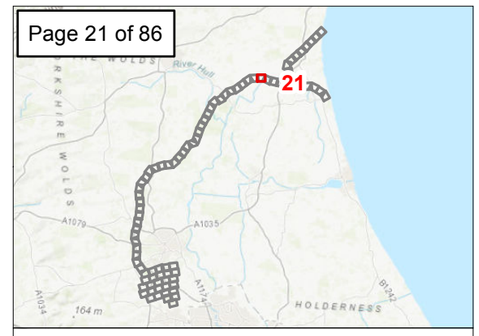
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- C3.2 - Other tall herb and fern - non ruderal
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings



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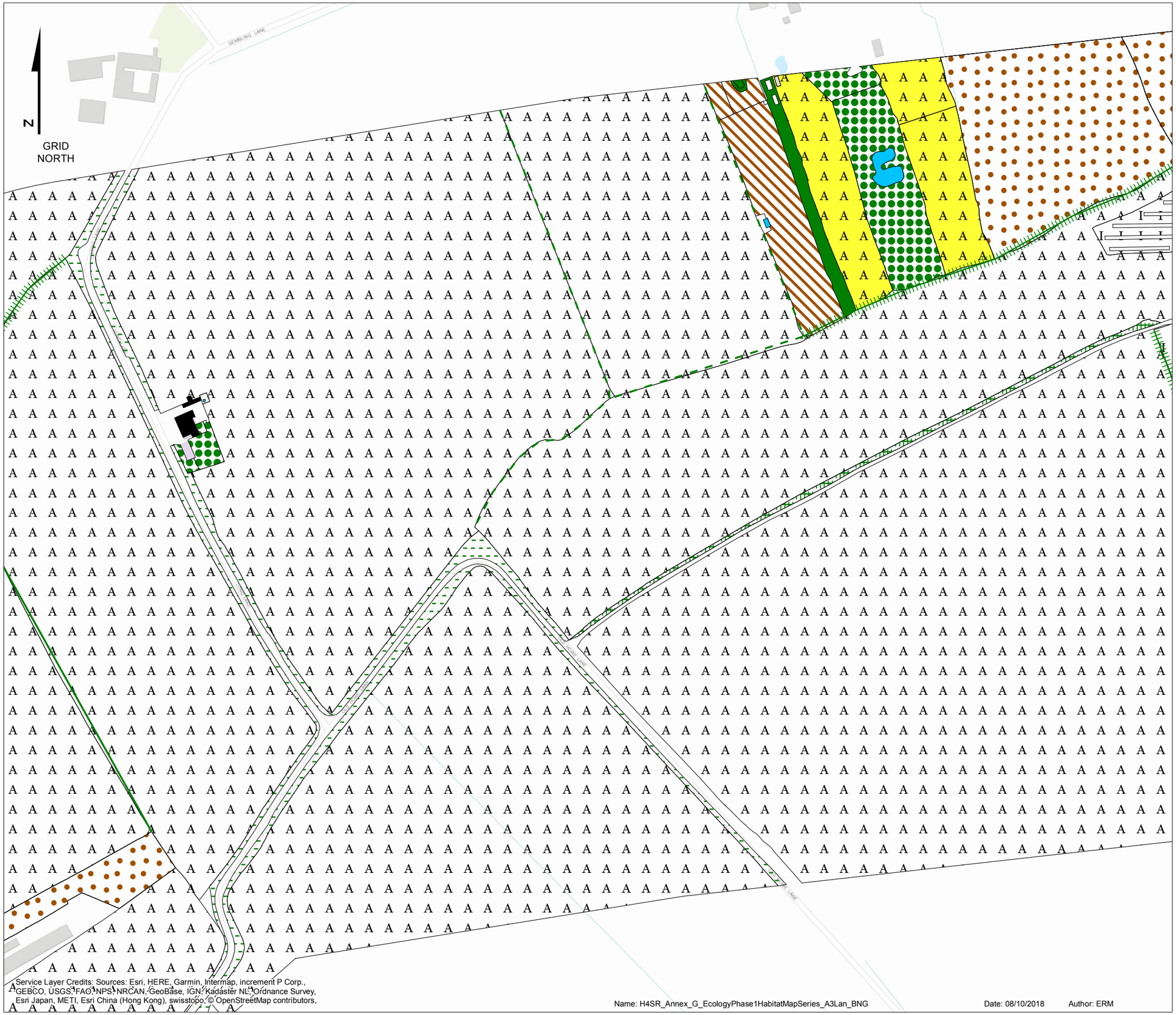
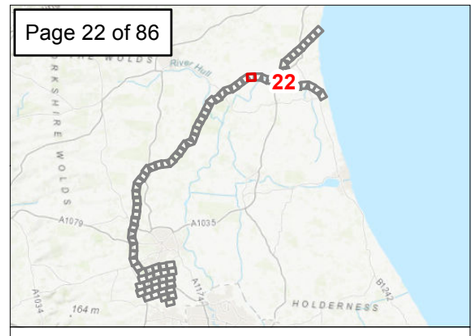
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- C3.2 - Other tall herb and fern - non ruderal
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings



Coordinate system: British National Grid

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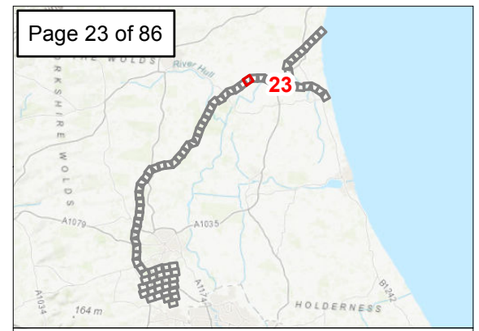
Phase 1 Habitat Survey
Map Series
Annex H

N

GRID
NORTH

- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- C3.2 - Other tall herb and fern - non ruderal
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.2.2 - Defunct hedge - species-poor
- J3.6 - Buildings



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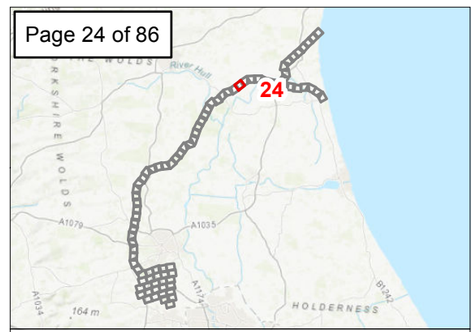
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

- Scoping Boundary
- Scoping Boundary Component
- SSSI Areas (Natural England)
- J2.1.2 - Intact hedge - species-poor
- J2.6 - Dry ditch
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
Document no: Annex H
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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

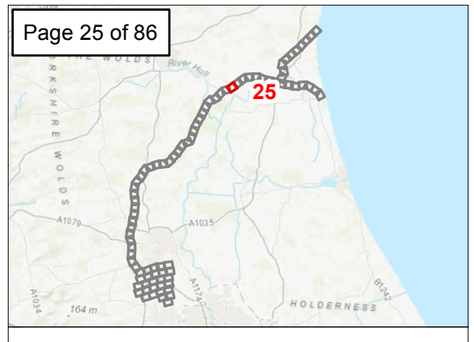
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

River Hull Headwaters Site of Special Scientific Interest

- Scoping Boundary
- Scoping Boundary Component
- SSSI Areas (Natural England)
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J2.6 - Dry ditch
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

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Phase 1 Habitat Survey Map Series
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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG

Date: 08/10/2018

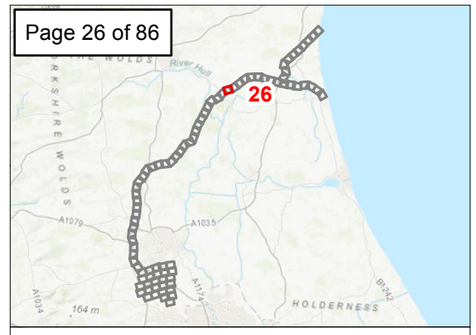
Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A2.1 - Scrub - dense/continuous
A2.2 - Scrub - scattered
A3.1 - Broadleaved Parkland/scattered trees
B2.2 - Neutral grassland - semi-improved
B4 - Improved grassland
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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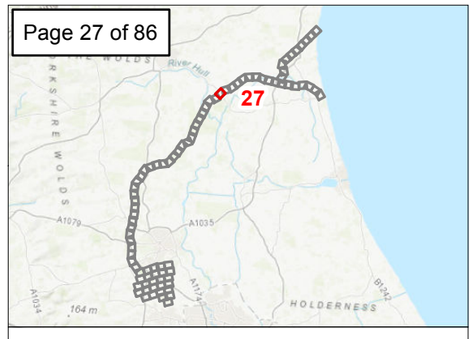
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B2.2 - Neutral grassland - semi-improved
- B4 - Improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J2.3.2 - Hedge with trees - species-poor
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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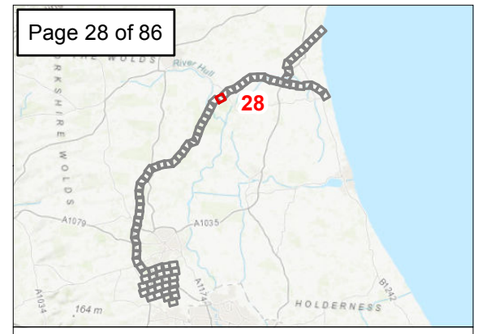
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J4 - Bare ground



Coordinate system: British National Grid

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Phase 1 Habitat Survey Map Series
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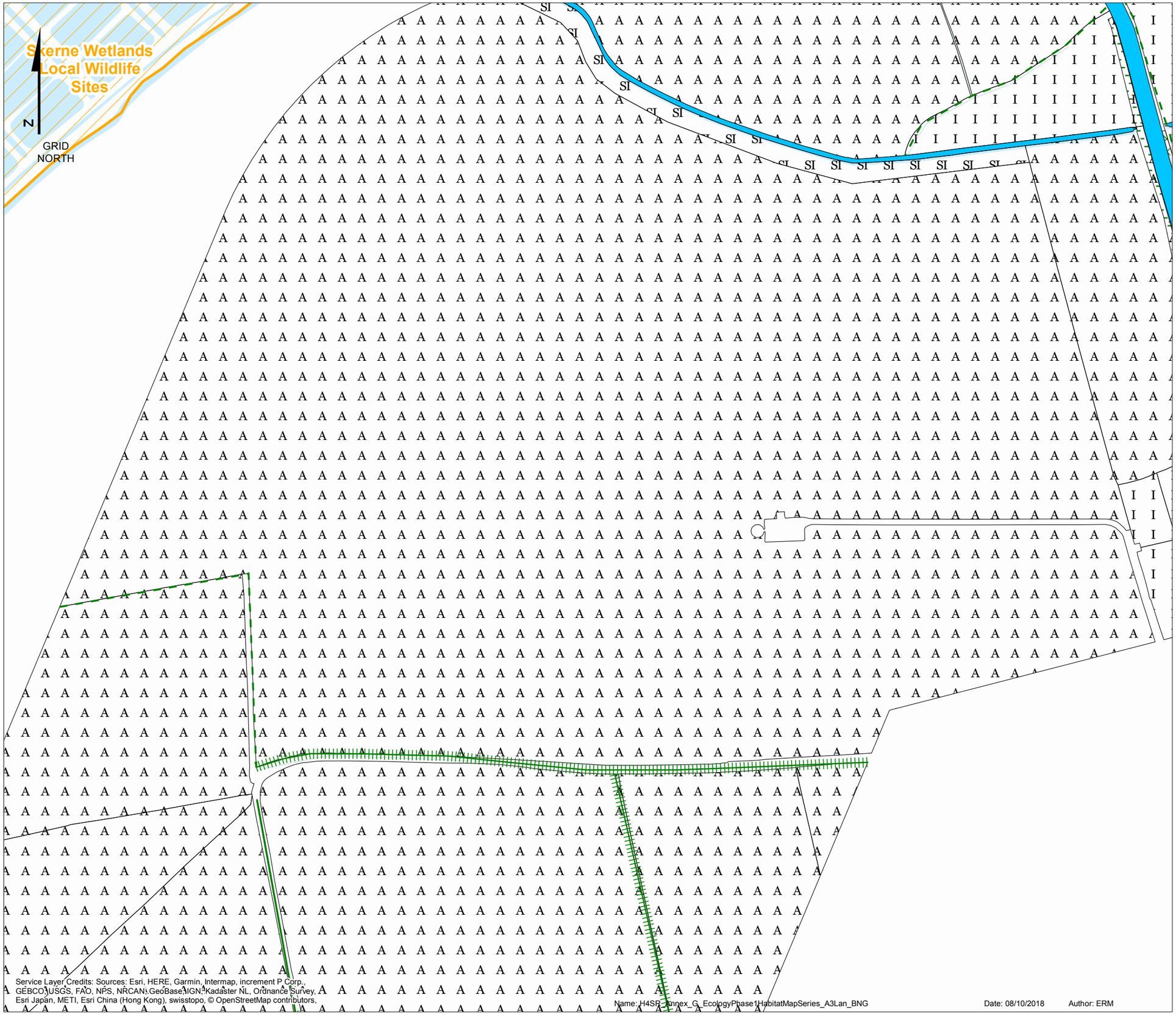
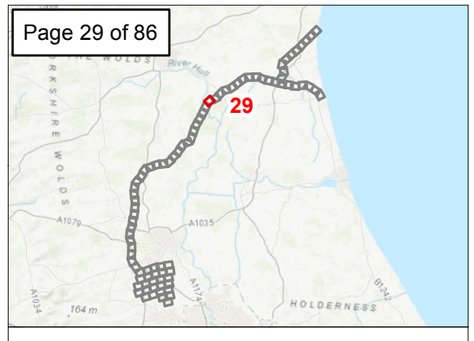
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG

Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A2.2 - Scrub - scattered
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.2.2 - Defunct hedge - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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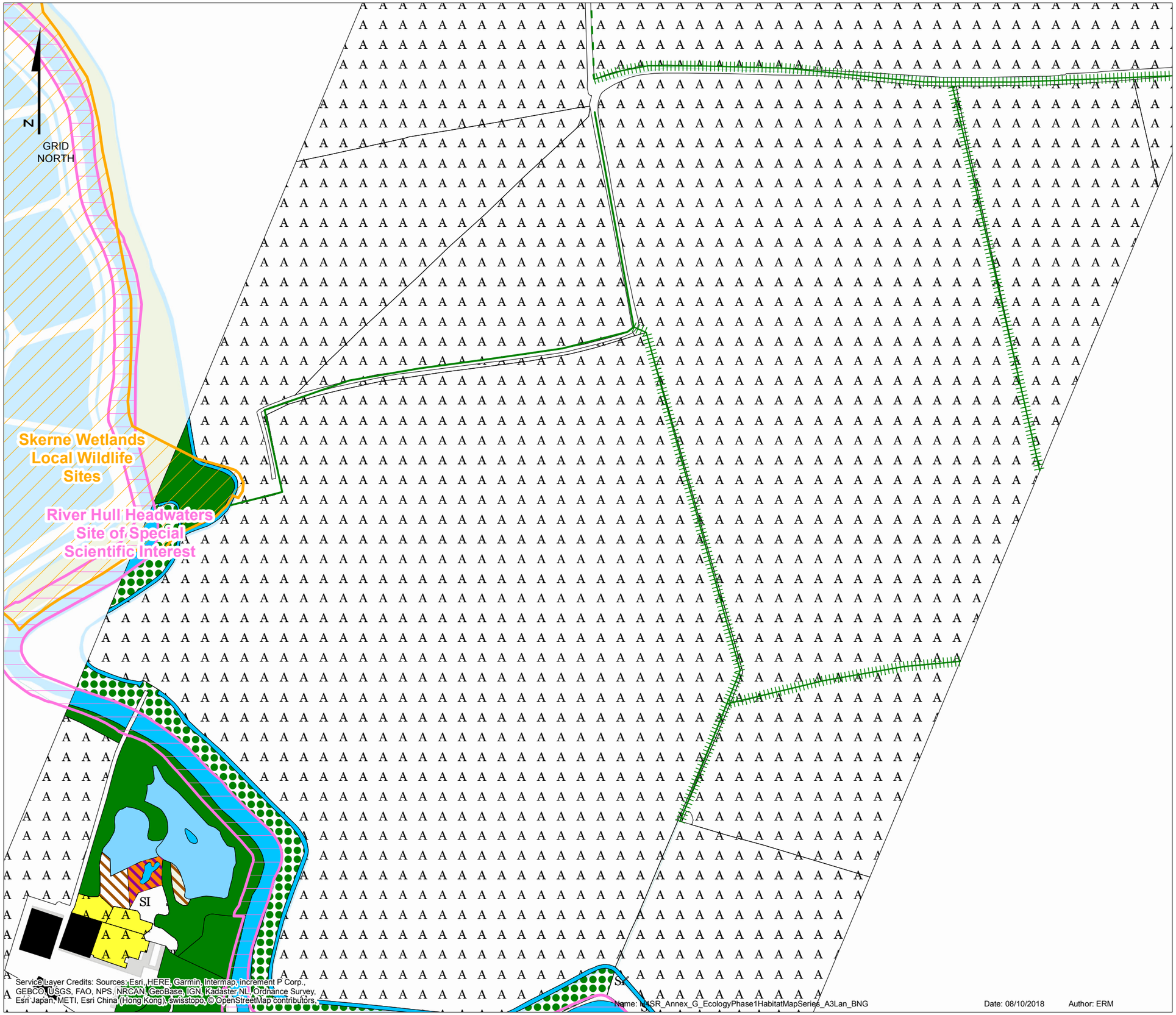
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG

Date: 08/10/2018

Author: ERM

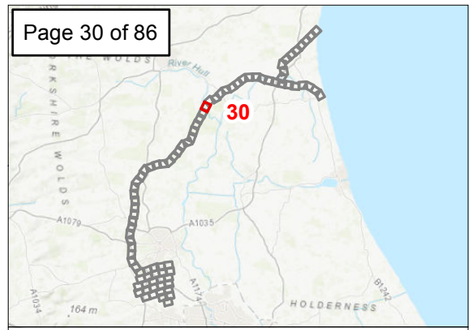
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors.

Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- SSSI Areas (Natural England)
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B5 - Marsh/marshy grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- F1 - Swamp
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
Document no: Annex H
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Checked by: JP
Approved by: NL

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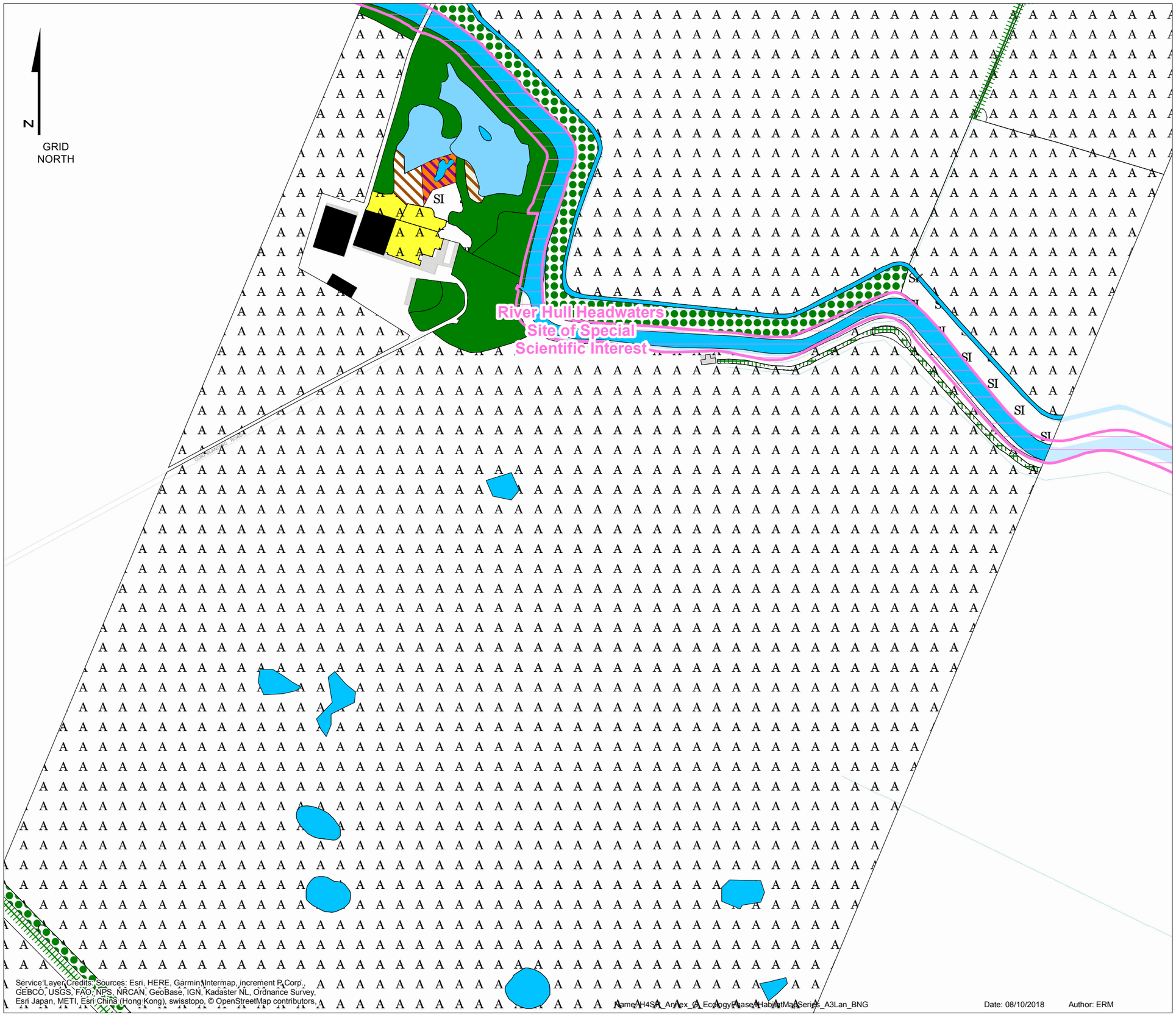
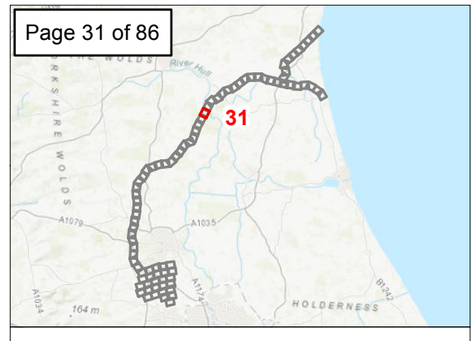
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- SSSI Areas (Natural England)
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B5 - Marsh/marshy grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- F1 - Swamp
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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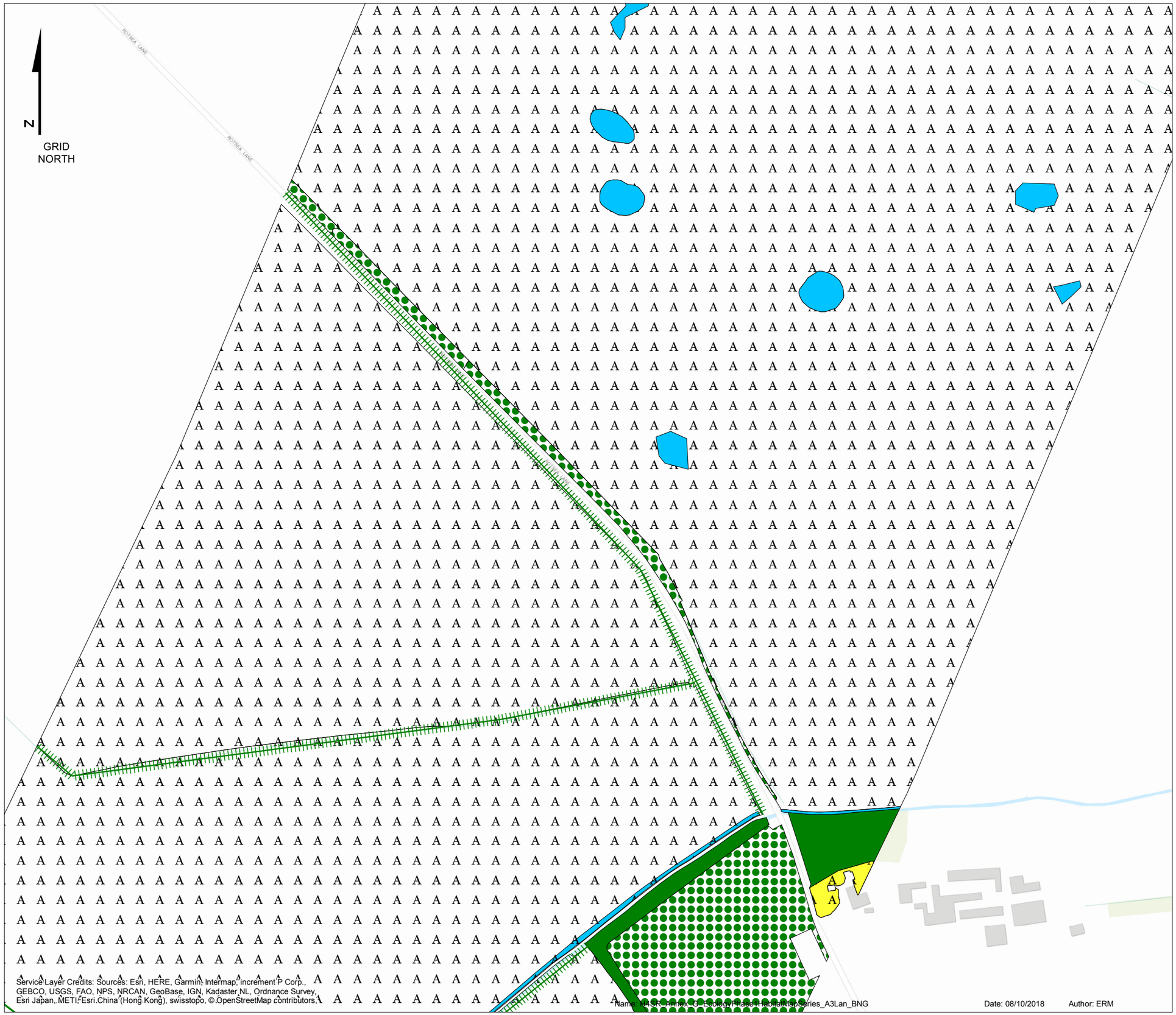
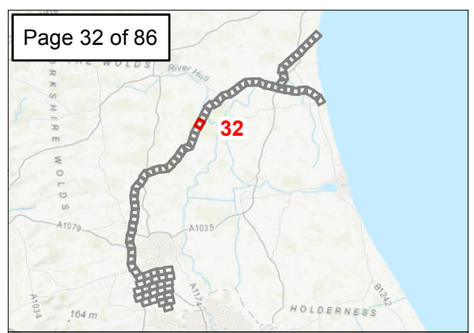
Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat
Survey Map Series
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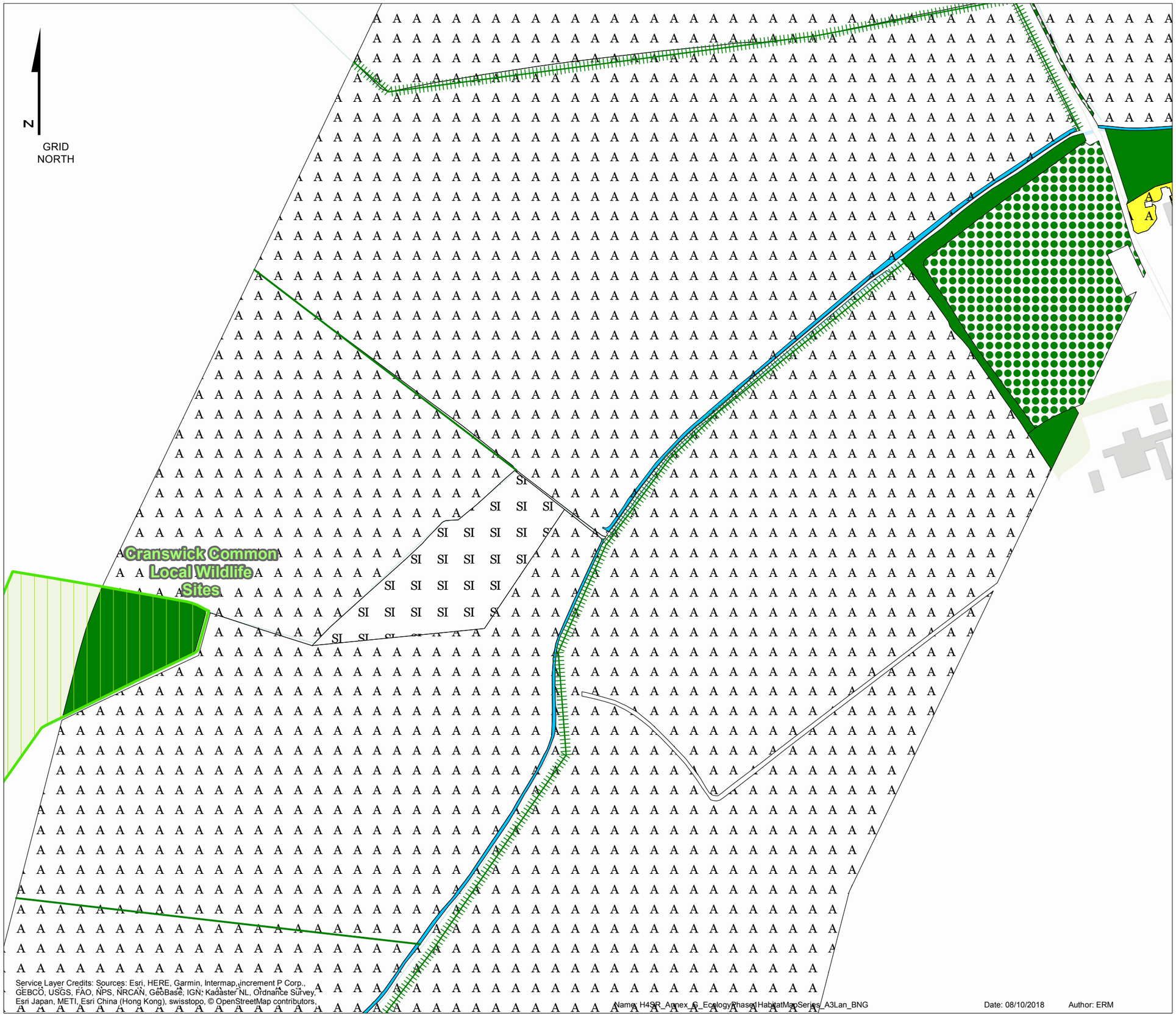
Name: MXD_Annex_G_Ecology_Phase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

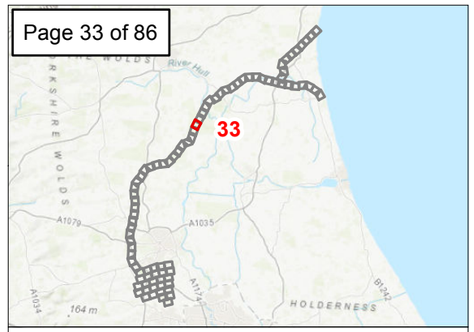
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors,

Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Candidate Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B6 - Poor semi-improved grassland
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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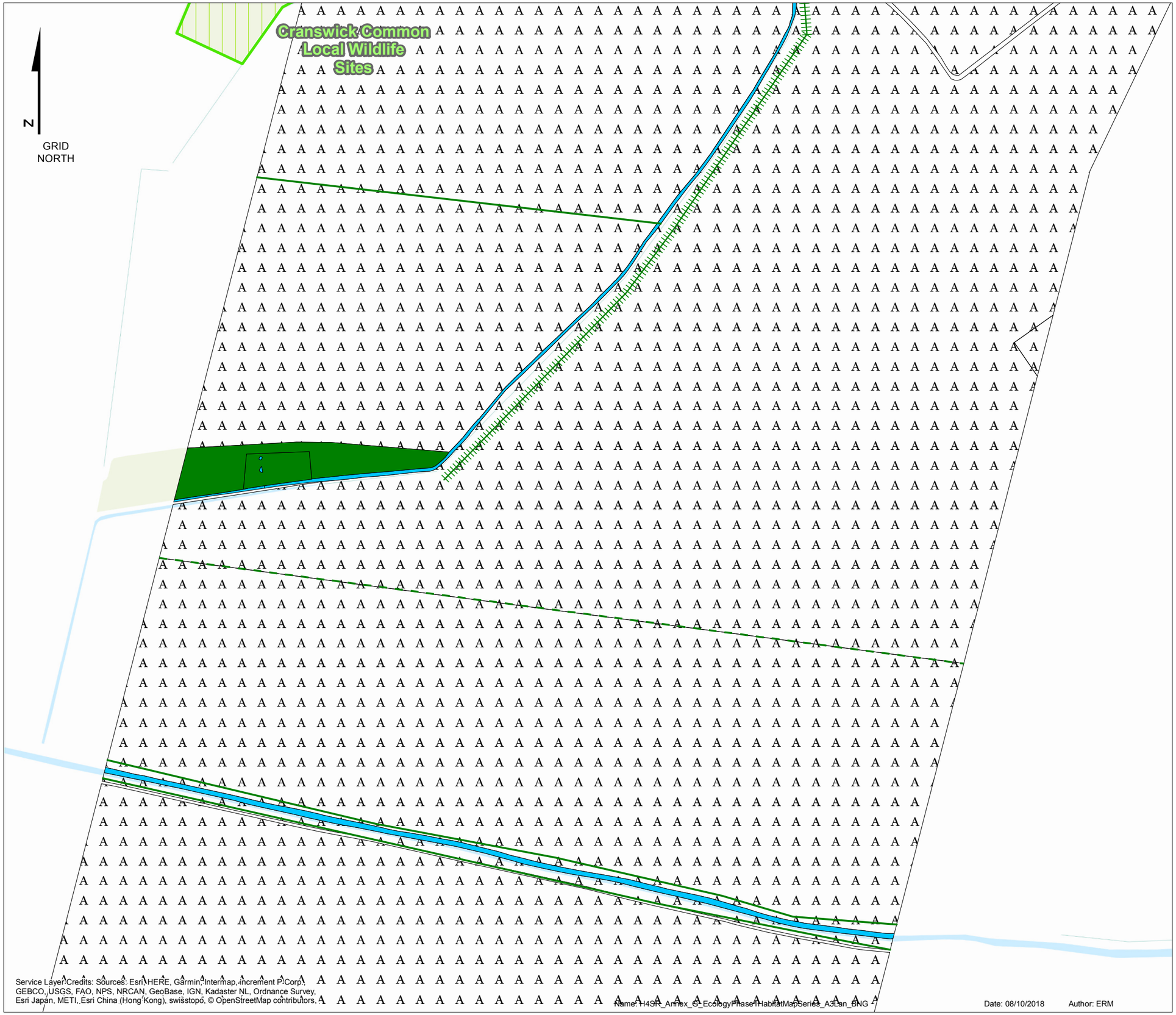
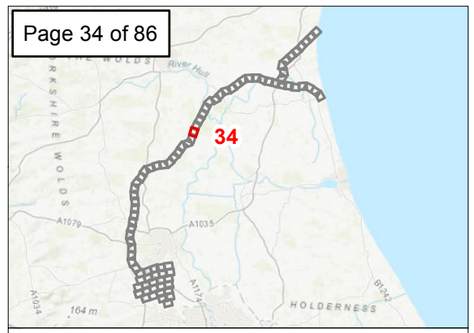
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
Candidate Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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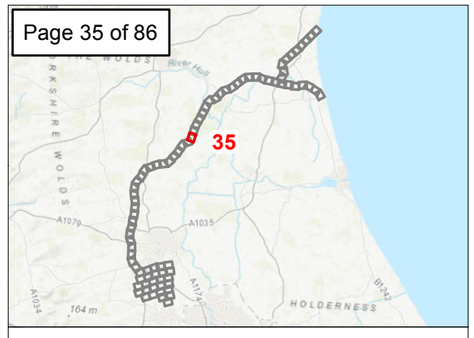
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H

N

GRID
NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat
Survey Map Series
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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG

Date: 08/10/2018

Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
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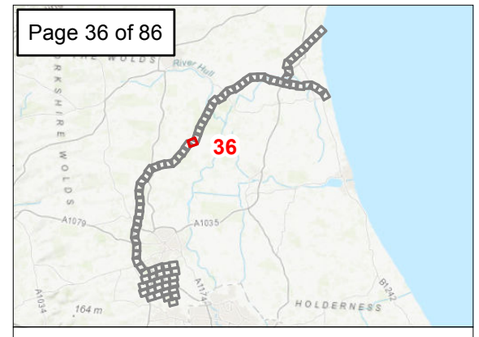
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.2.2 - Defunct hedge - species-poor
J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

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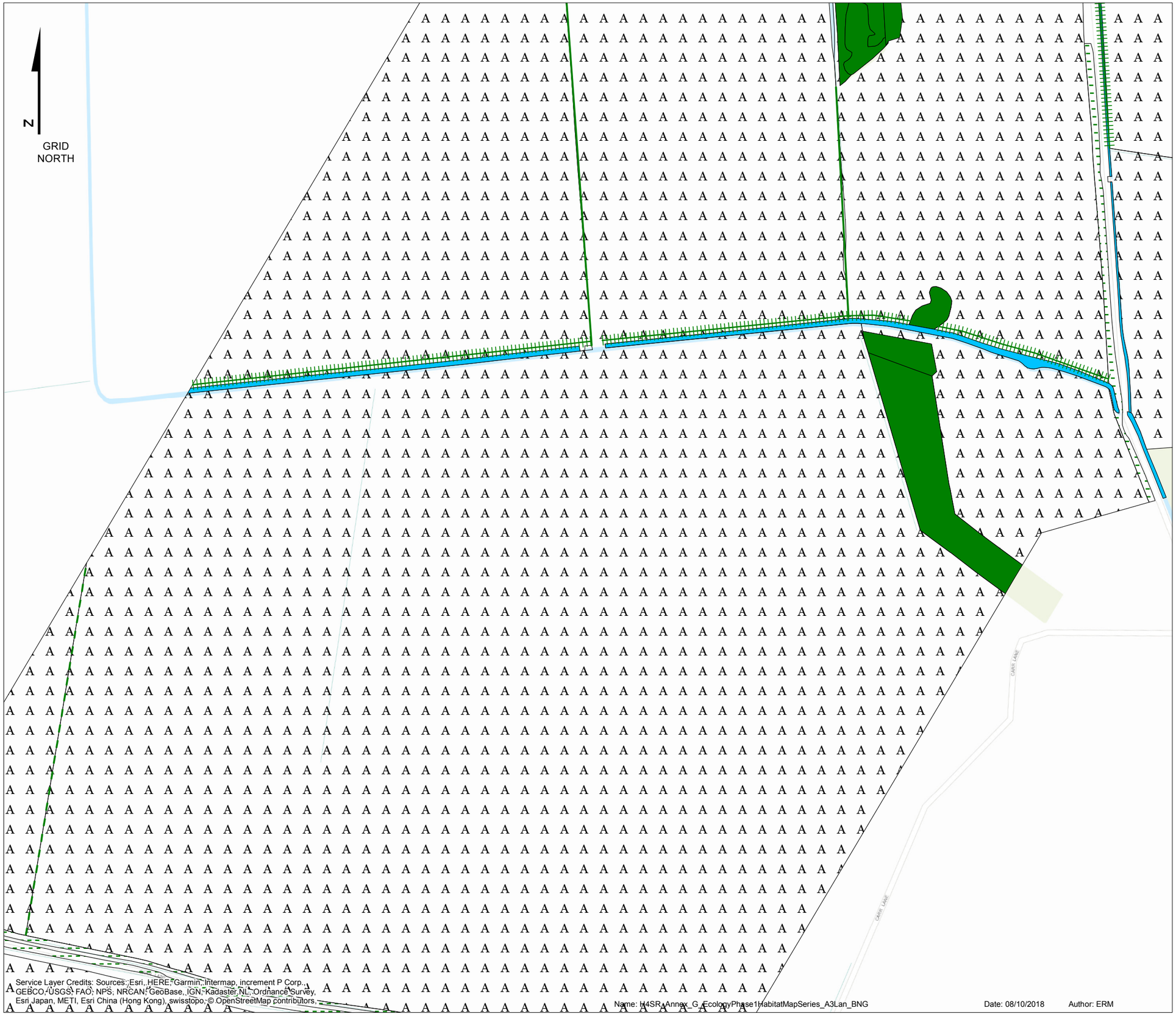
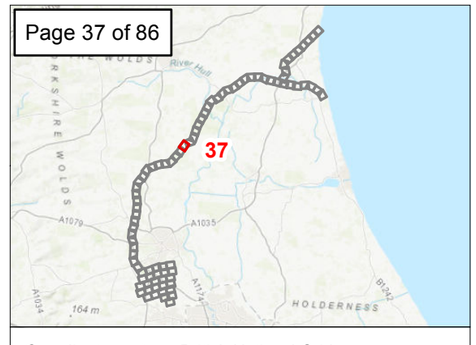
Annex H



Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J2.2.2 - Defunct hedge - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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Document no: Annex H
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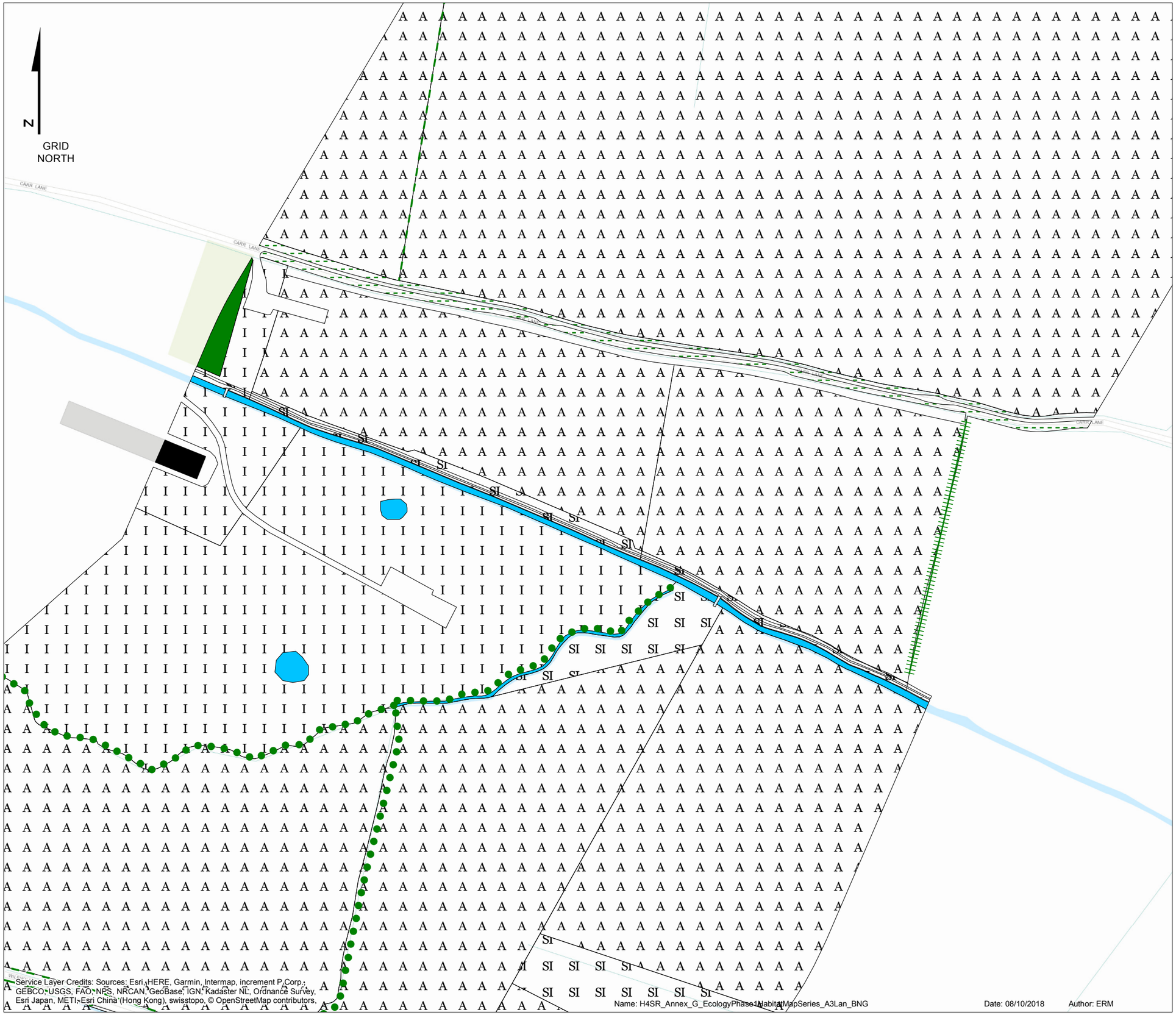
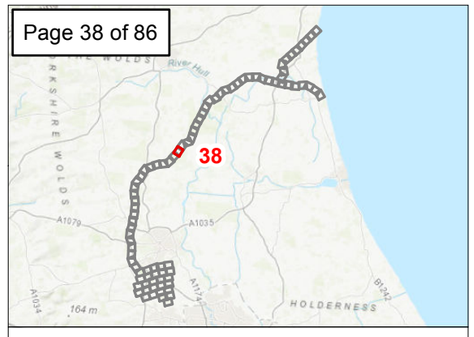


- Scoping Boundary
- Scoping Boundary Component
- A3.1 - Broadleaved Parkland/scattered trees
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.2.2 - Defunct hedge - species-poor
- J3.6 - Buildings



Coordinate system: British National Grid

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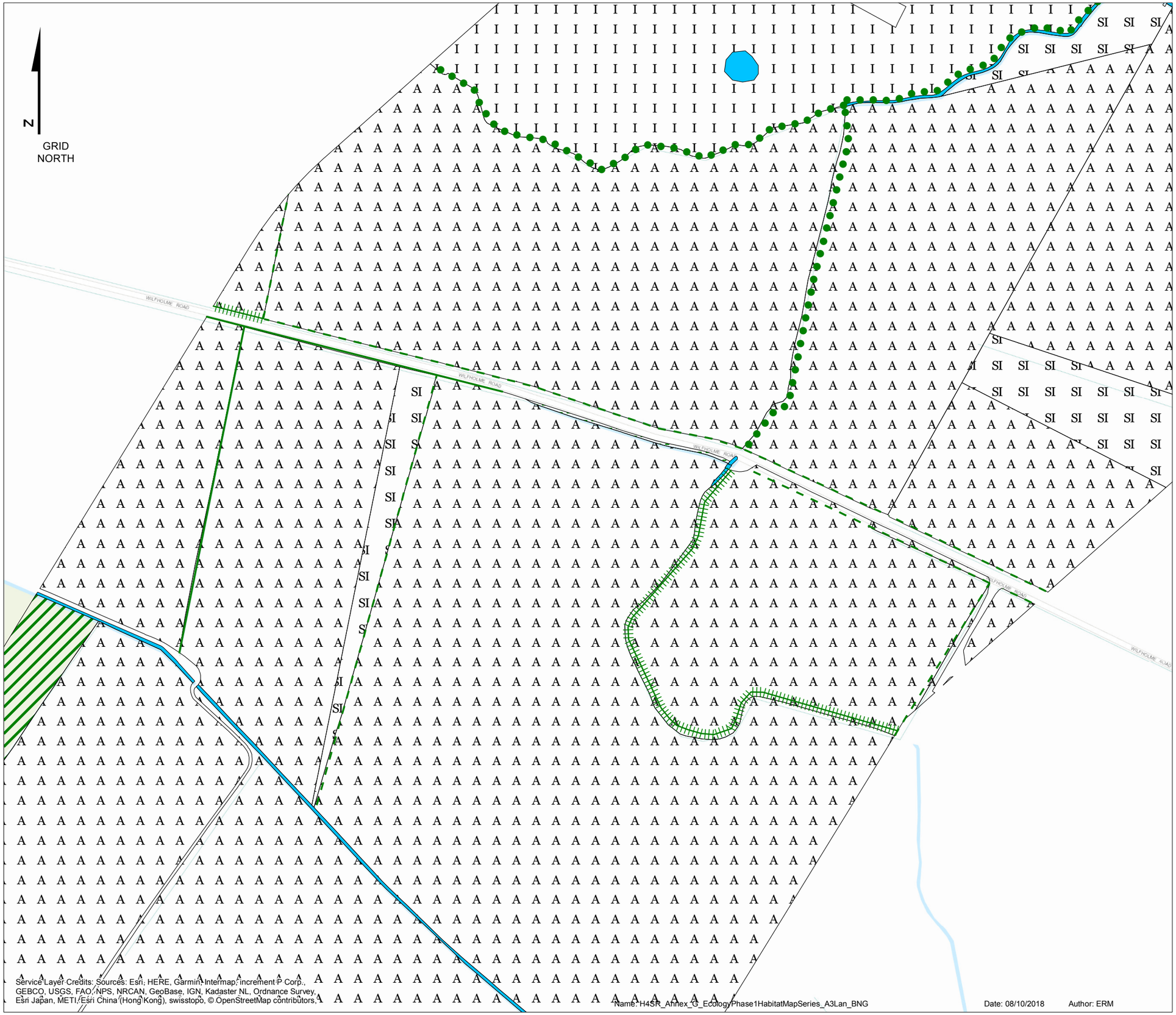
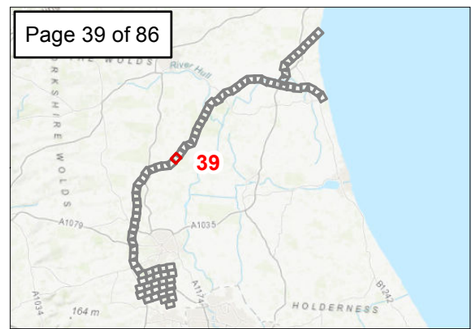


Scoping Boundary
Scoping Boundary Component
A3.1 - Broadleaved Parkland/scattered trees
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.2 - Broadleaved woodland - plantation
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J2.2.2 - Defunct hedge - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

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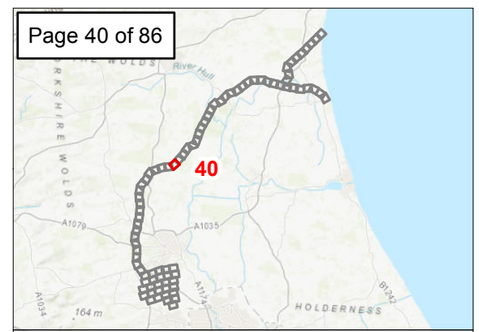
Phase 1 Habitat Survey
Map Series
Annex H

N
GRID NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A1.1.2 - Broadleaved woodland - plantation
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J3.6 - Buildings



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0 50 100 150 200 Yards

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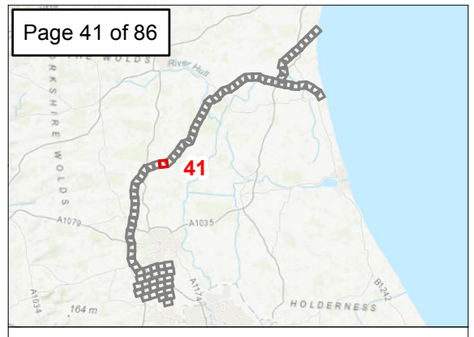
GRID NORTH

BEWICK ROAD

- Scoping Boundary
- Scoping Boundary Component
- A3.1 - Broadleaved Parkland/scattered trees
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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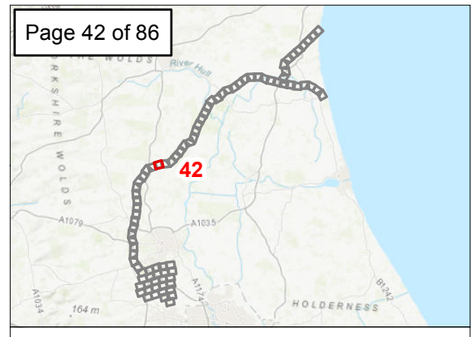
N

GRID
NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.1 - Hedge with trees - native species-rich
J2.3.2 - Hedge with trees - species-poor
A3.1 - Broadleaved Parkland/scattered trees
B6 - Poor semi-improved grassland
C3.1 - Other tall herb and fern - ruderal
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor



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0 50 100 150 200 Yards

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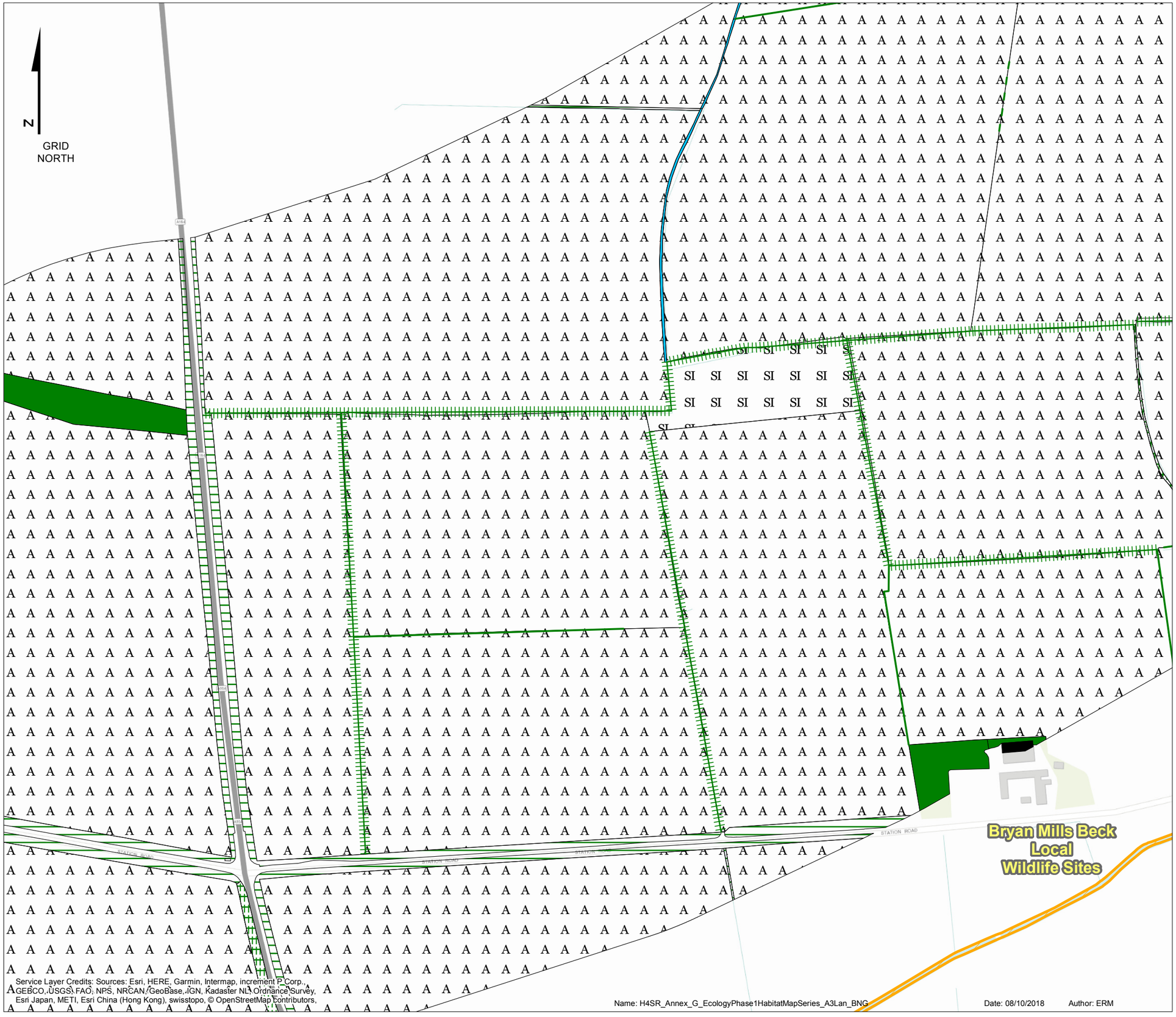
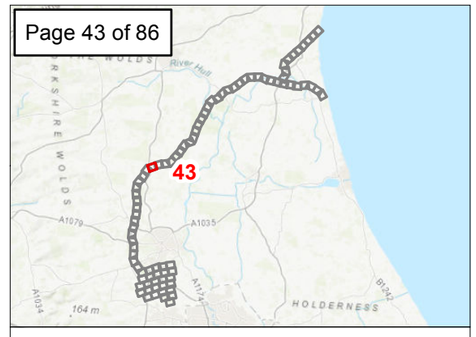


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- SI B6 - Poor semi-improved grassland
- G1 - Standing water
- A J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings



Coordinate system: British National Grid

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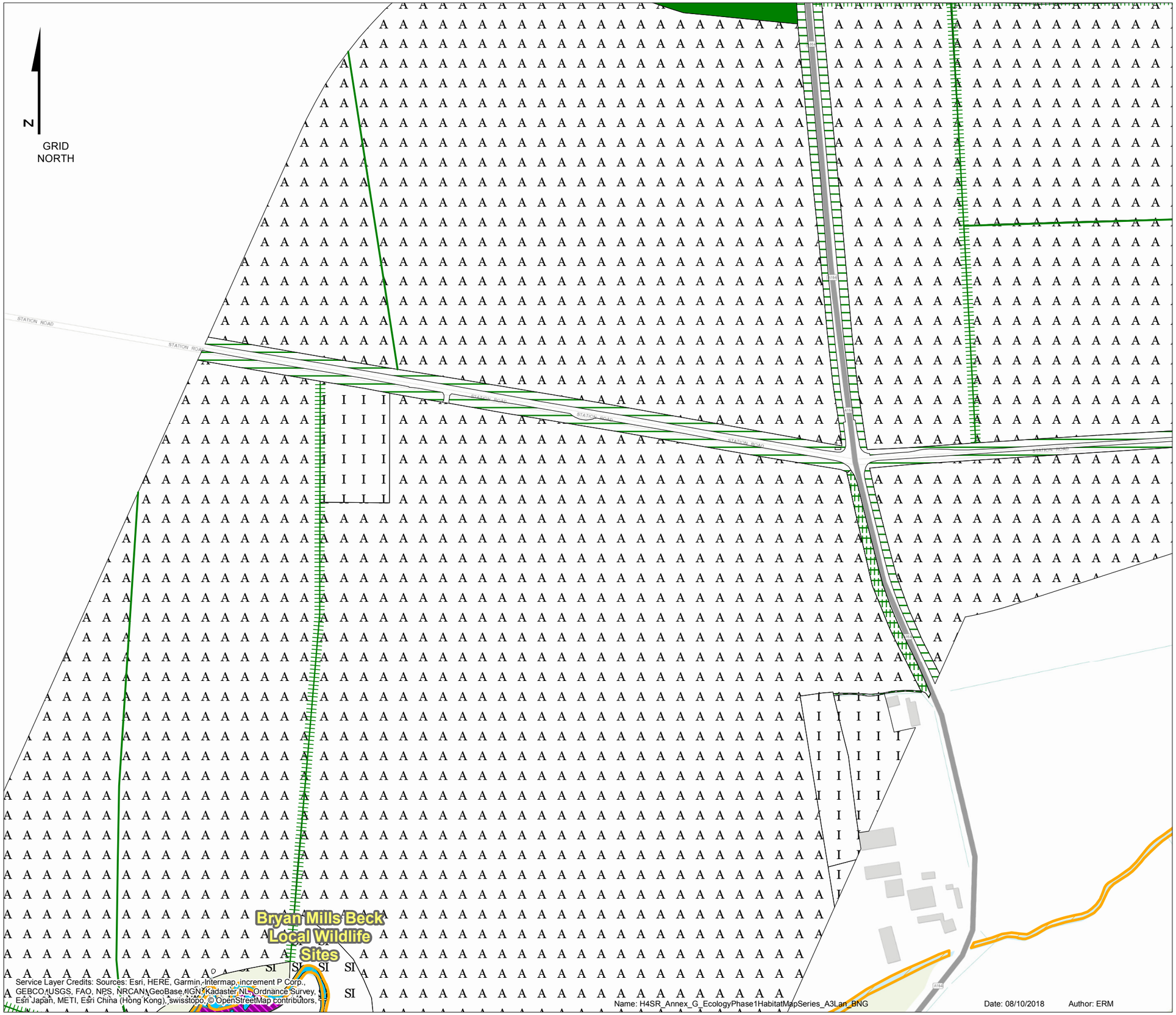
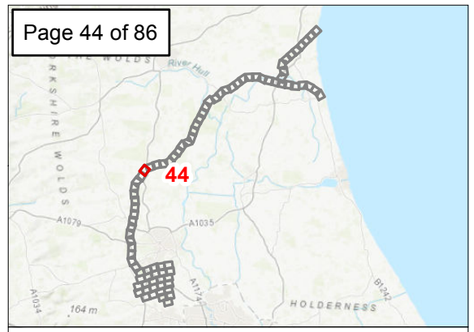


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- E3 - Fen
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor



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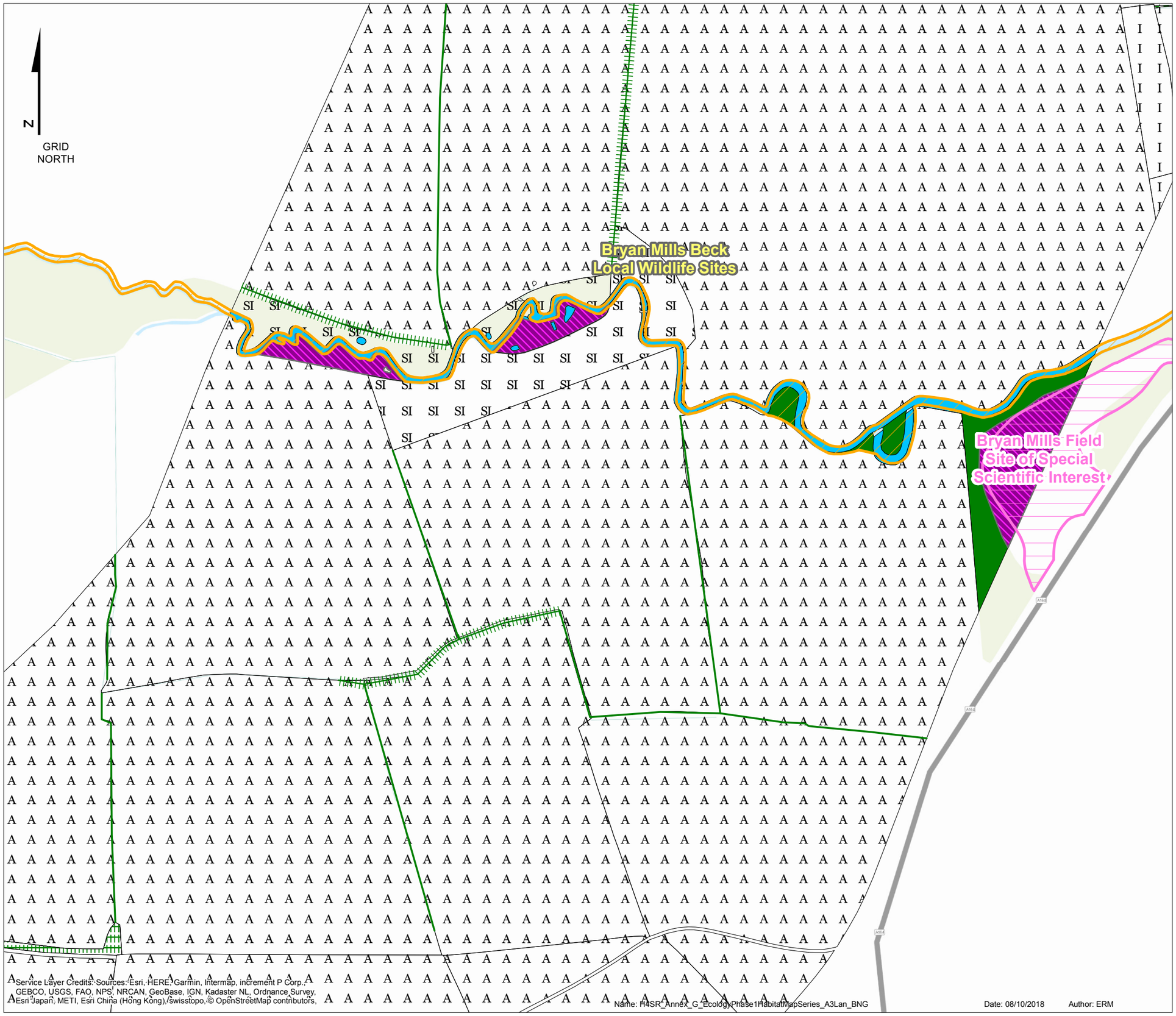
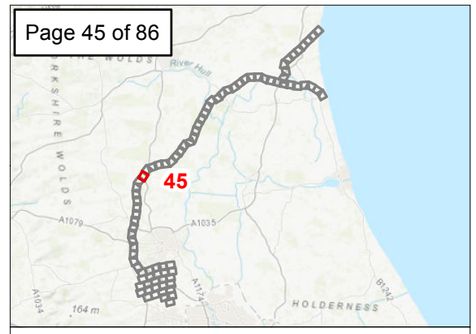


Scoping Boundary
Scoping Boundary Component
Designated Local Wildlife Site
SSSI Areas (Natural England)
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
B6 - Poor semi-improved grassland
E3 - Fen
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J2.3.2 - Hedge with trees - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

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Phase 1 Habitat Survey Map Series
Annex H

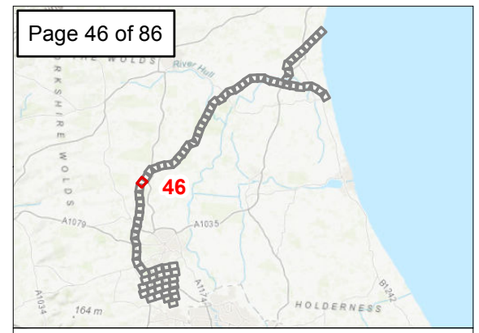
N

GRID NORTH

Bealey's Beck, Lockington Local Wildlife Sites

Lake's Wood Local Wildlife Sites

Scoping Boundary
Scoping Boundary Component
Candidate Local Wildlife Site
Designated Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor



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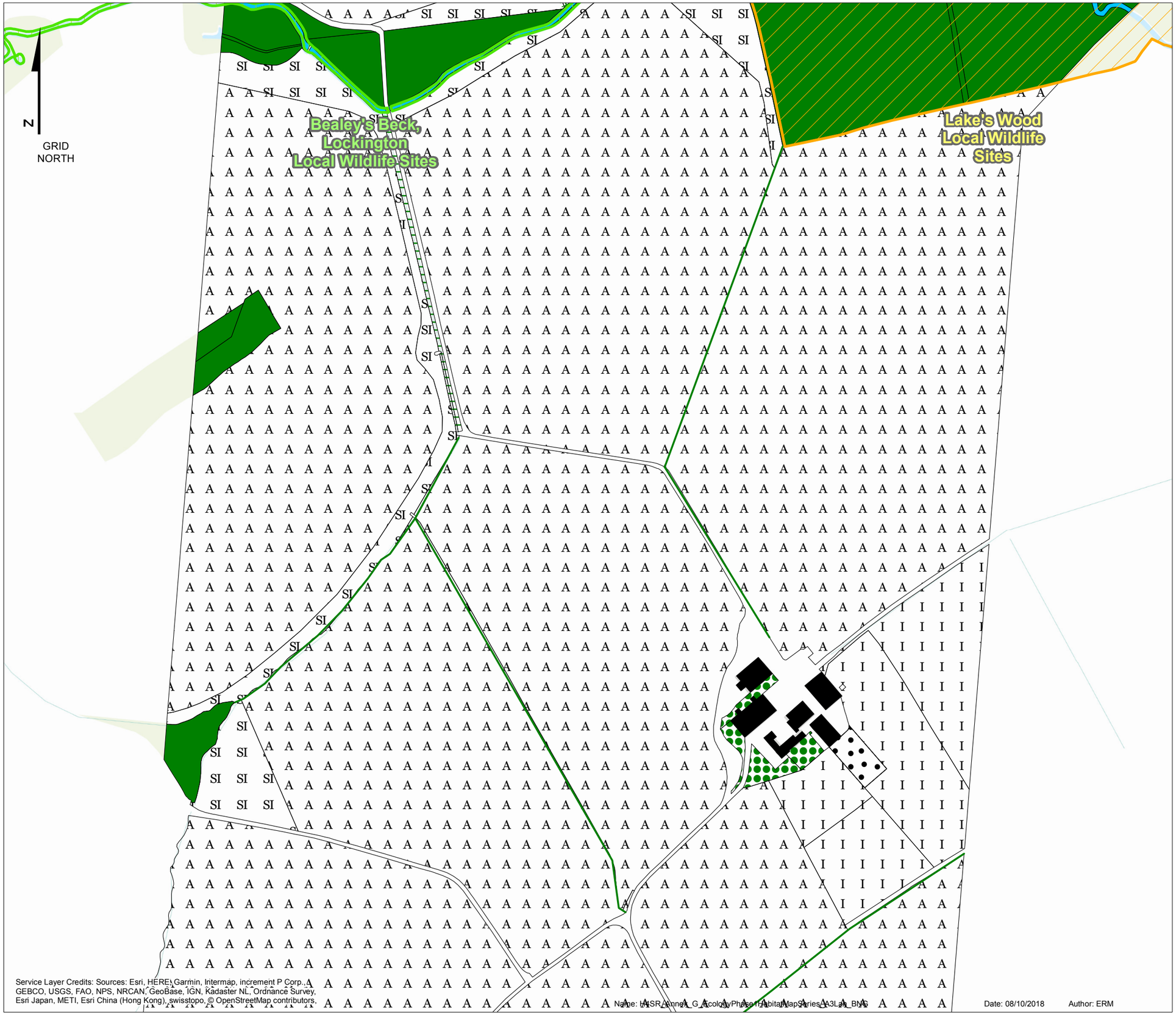
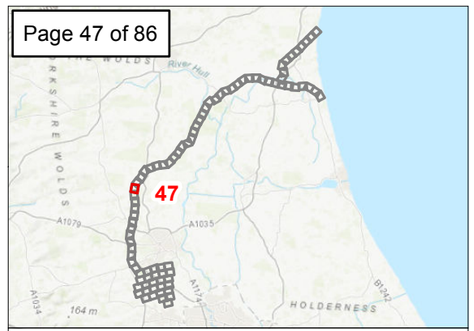
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Candidate Local Wildlife Site
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



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0 50 100 150 200 Yards

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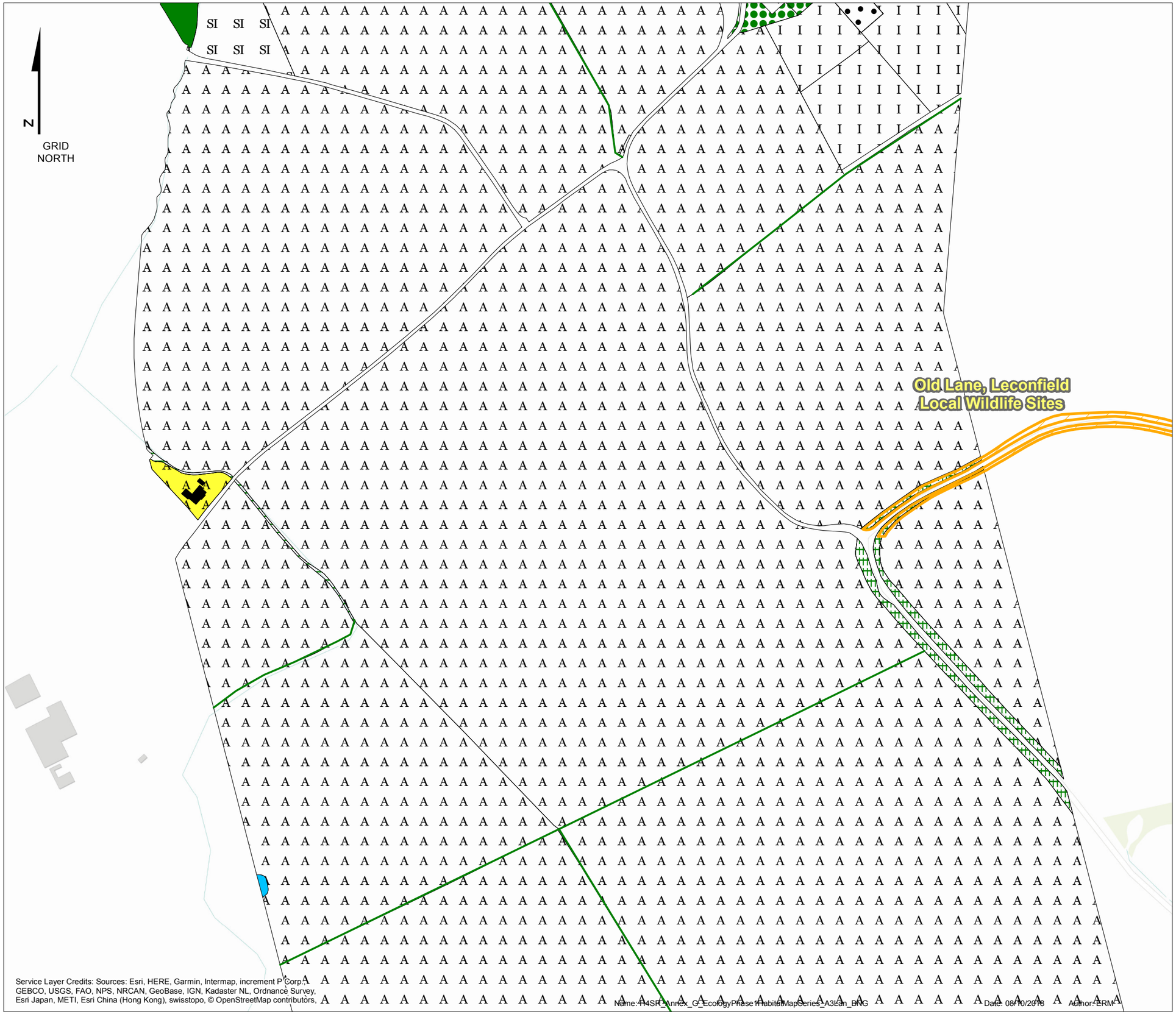
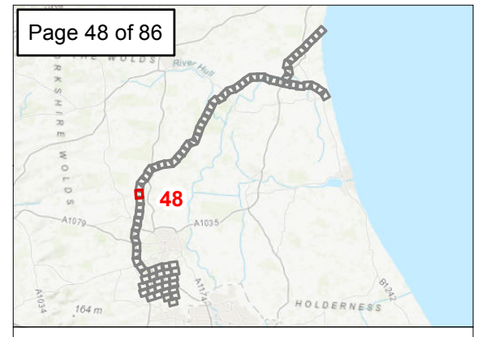


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings
- J4 - Bare ground



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0 50 100 150 200 Yards

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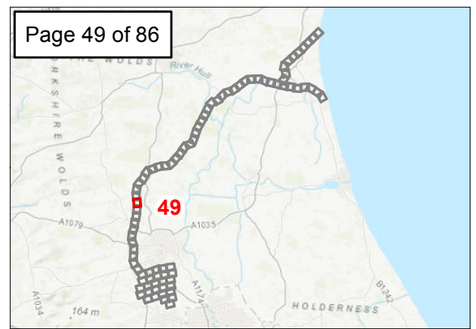
Annex H

N

GRID NORTH

Bygot Wood Lane, Leconfield Local Wildlife Sites

- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings



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0 50 100 150 200 Yards

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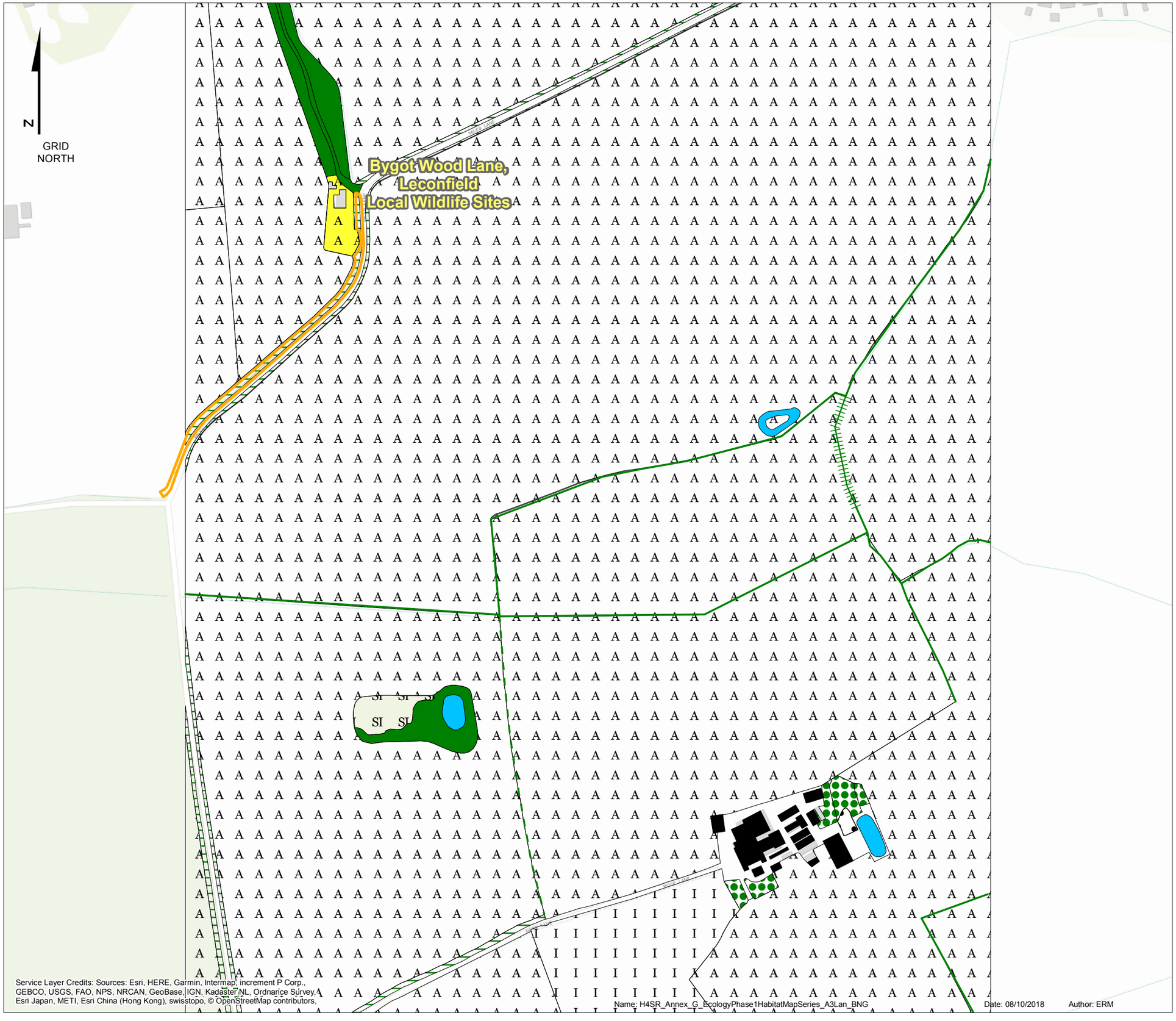
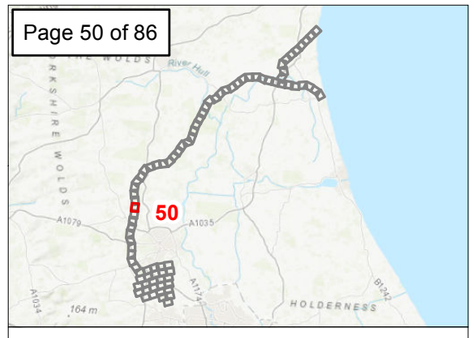


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



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0 50 100 150 200 Yards

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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

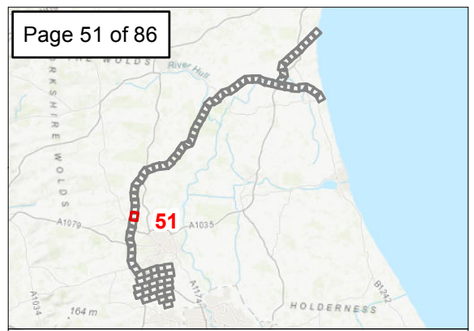
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

Raventhorpe Embankment Local Wildlife Sites

- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
Document no: Annex H
Created by: AA
Checked by: JP
Approved by: NL

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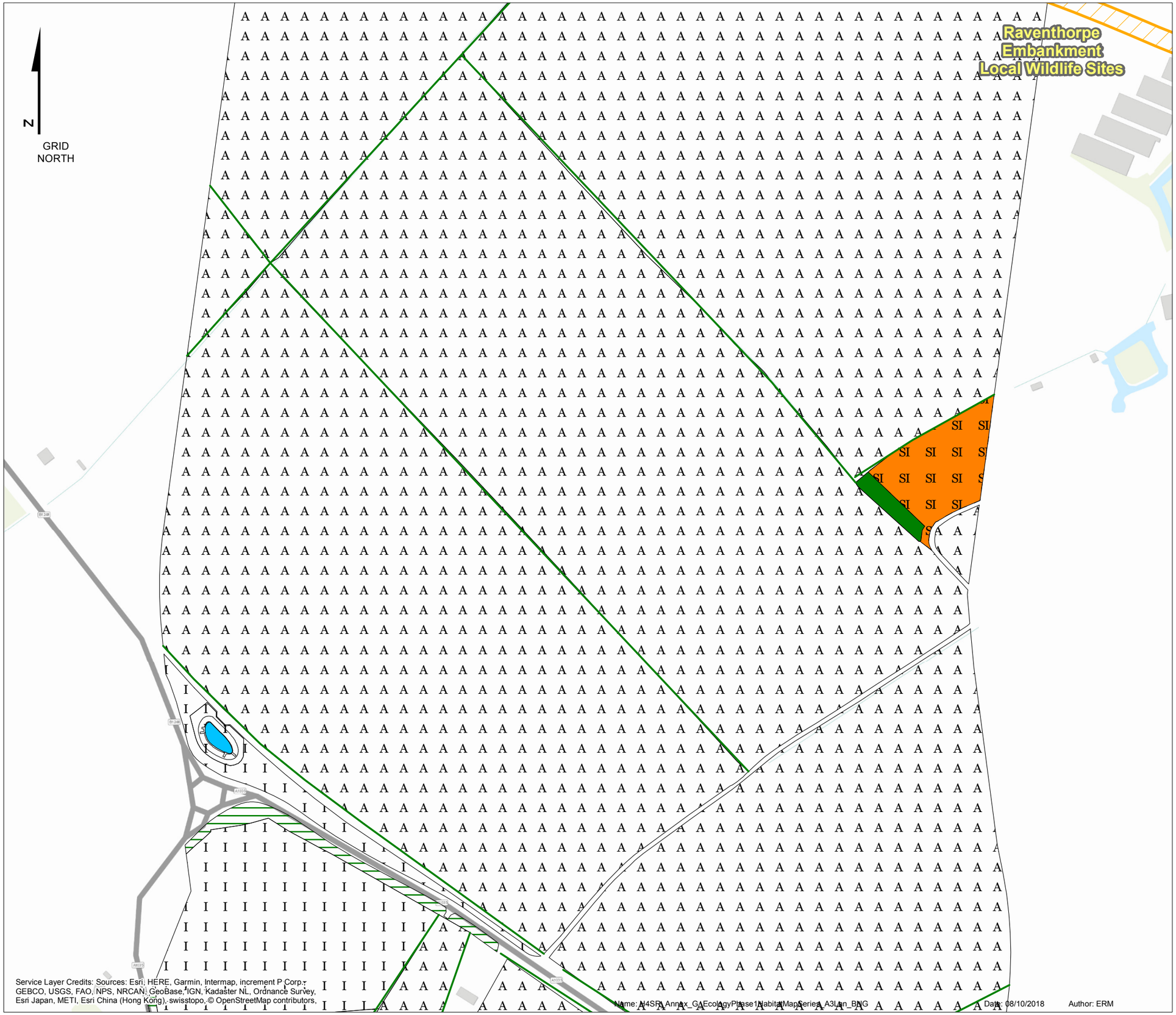
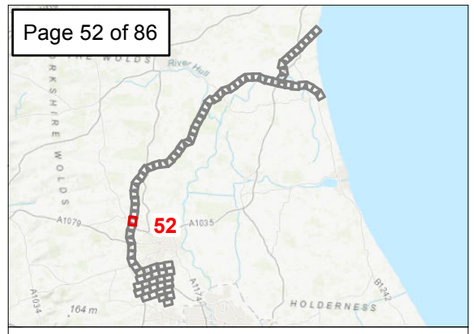
Name:H4SPA_Annex_GA_EcologyPhase1HabitatMapSeries_A3Jan_PNG

Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
Designated Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
B2.2 - Neutral grassland - semi-improved
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J2.1.2 - Intact hedge - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
Document no: Annex H
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Checked by: JP
Approved by: NL

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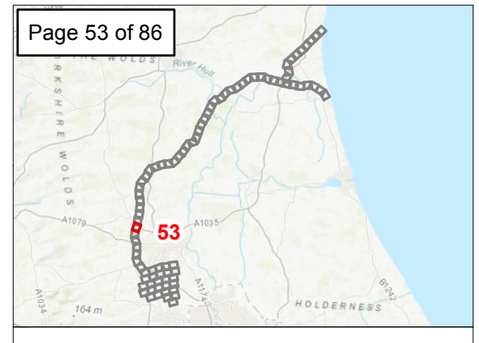
Name: N4SR_Annex_GA_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
J3.6 - Buildings
J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
Document no: Annex H
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Checked by: JP
Approved by: NL

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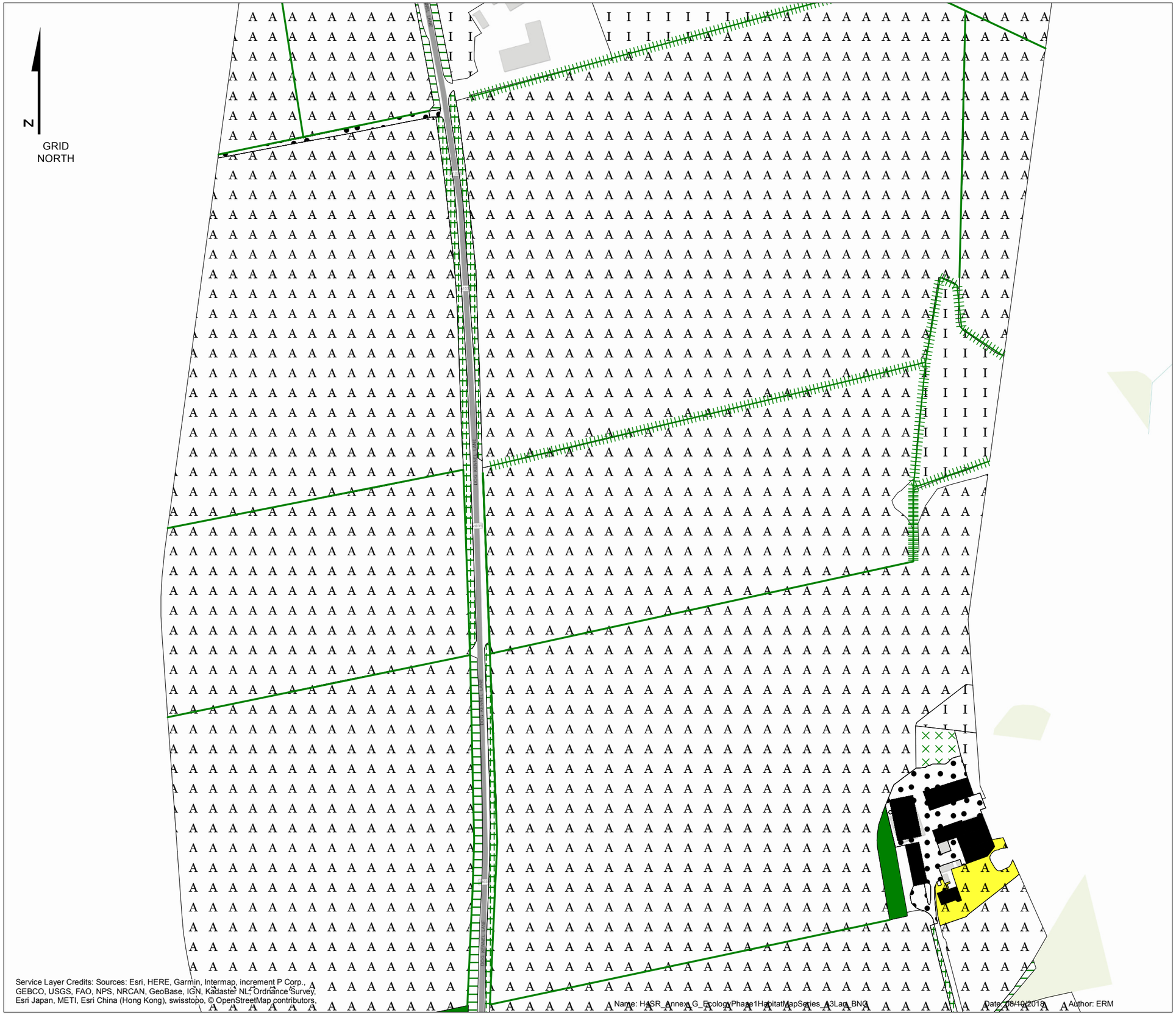
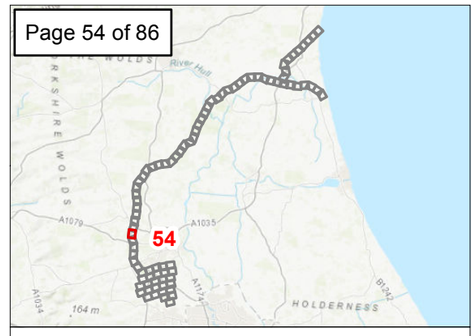
Name: HOSR_Annex_G_EcologyPhase1HabitatMapSeries_A3Land_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- B4 - Improved grassland
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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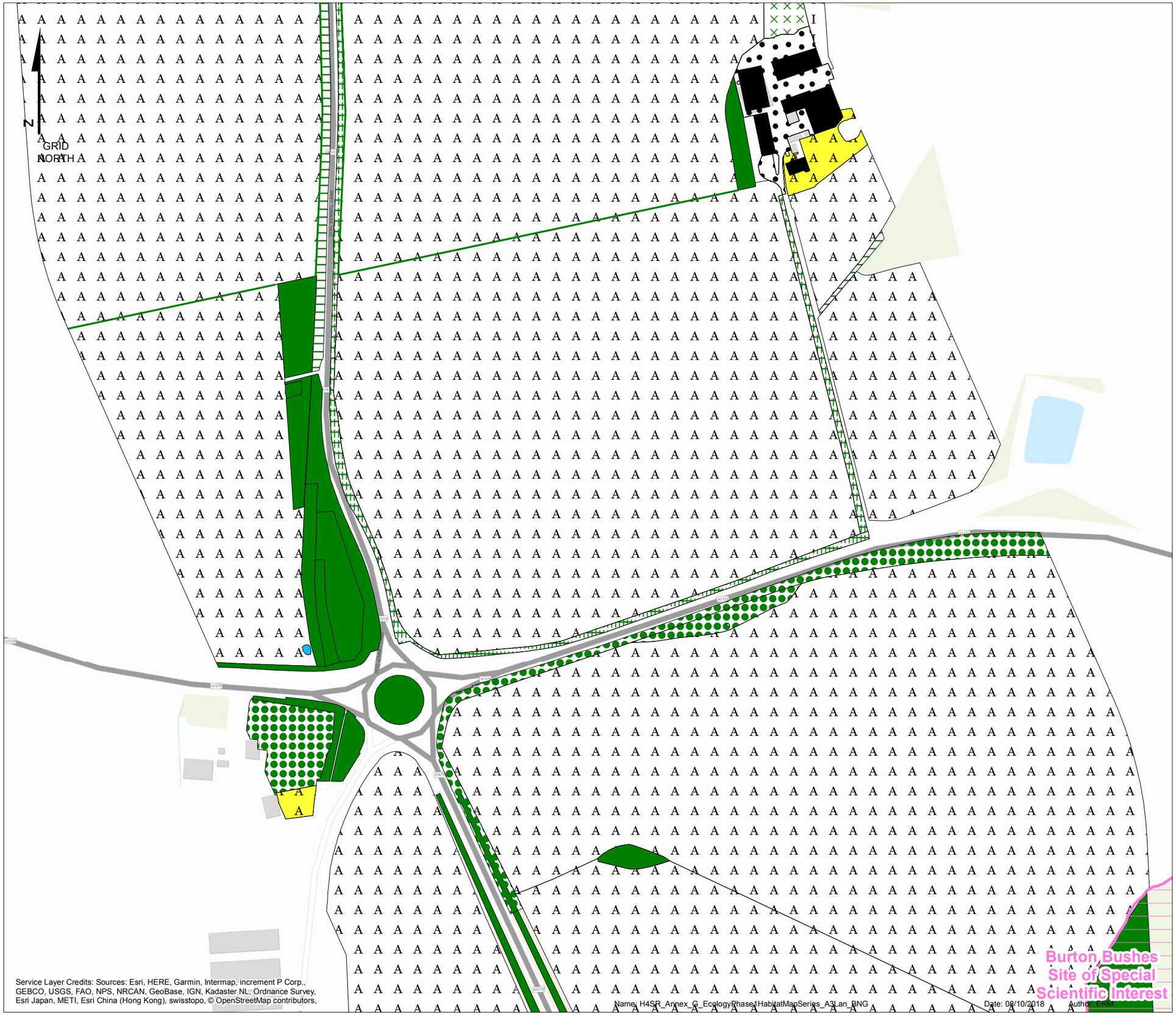
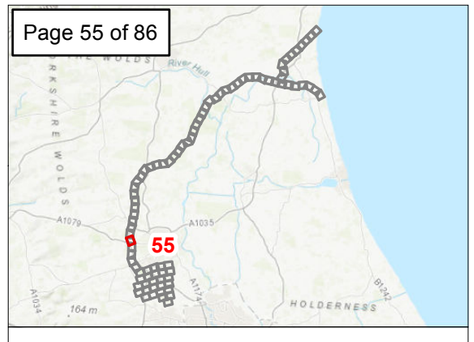
Name: HASR_Annex G_EcologyPhase1HabitatMapSeries_A3Land_BNG Date: 08/10/2019 Author: ERM

Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
SSSI Areas (Natural England)
J2.1.2 - Intact hedge - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A2.2 - Scrub - scattered
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
G1 - Standing water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
J3.6 - Buildings
J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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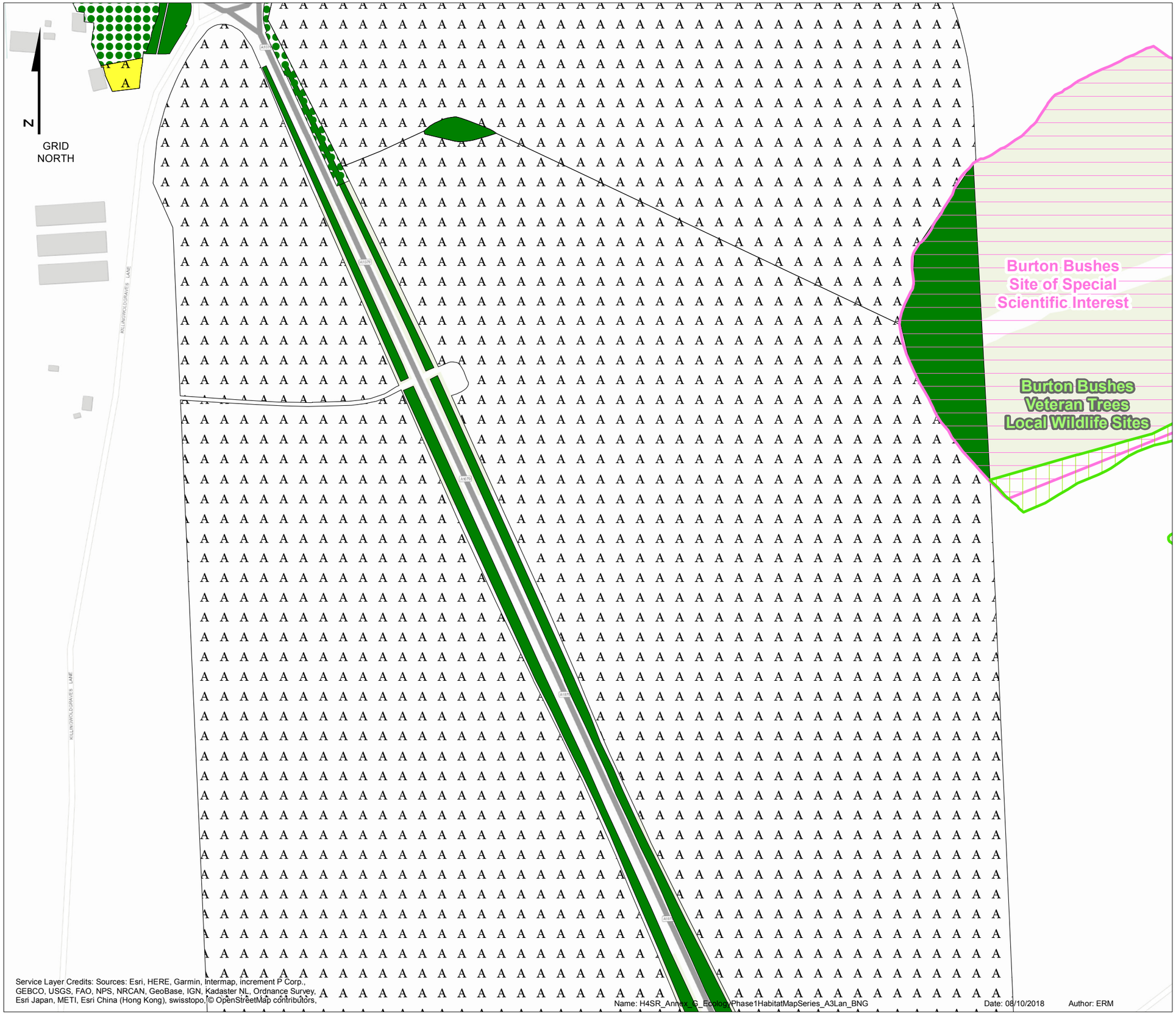
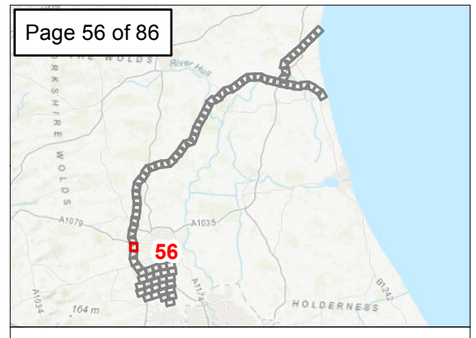
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
Candidate Local Wildlife Site
SSSI Areas (Natural England)
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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Name: H4SR_Annex_G_Ecology\Phase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

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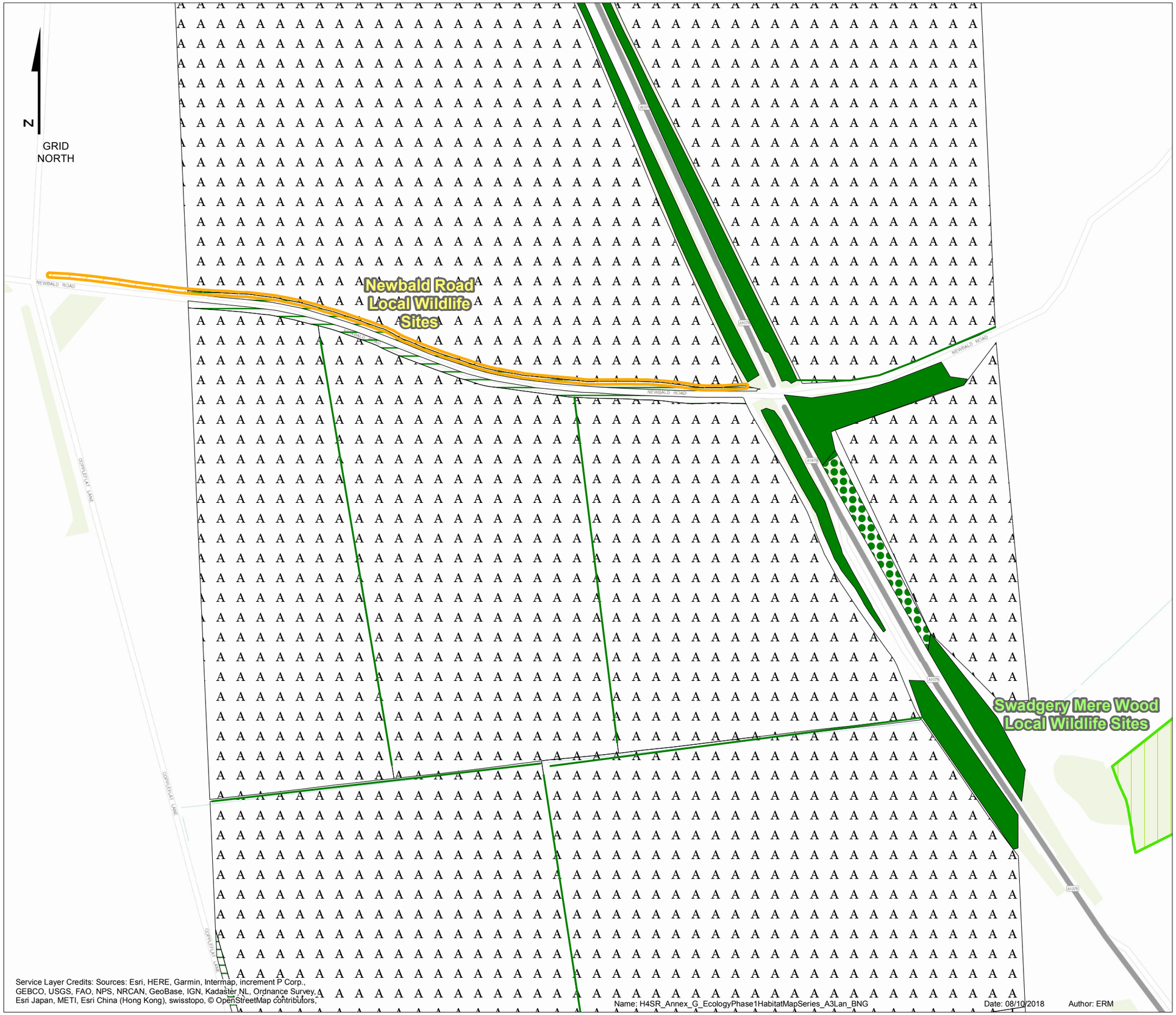
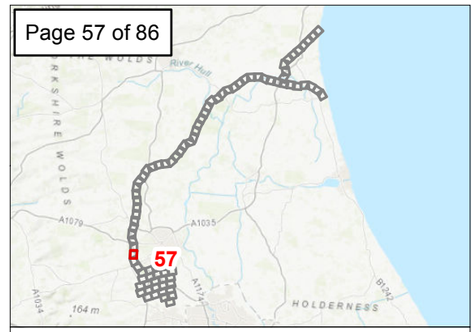
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
Candidate Local Wildlife Site
Designated Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
J1.1 - Cultivated/disturbed land - arable
J2.1.2 - Intact hedge - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

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Phase 1 Habitat Survey Map Series
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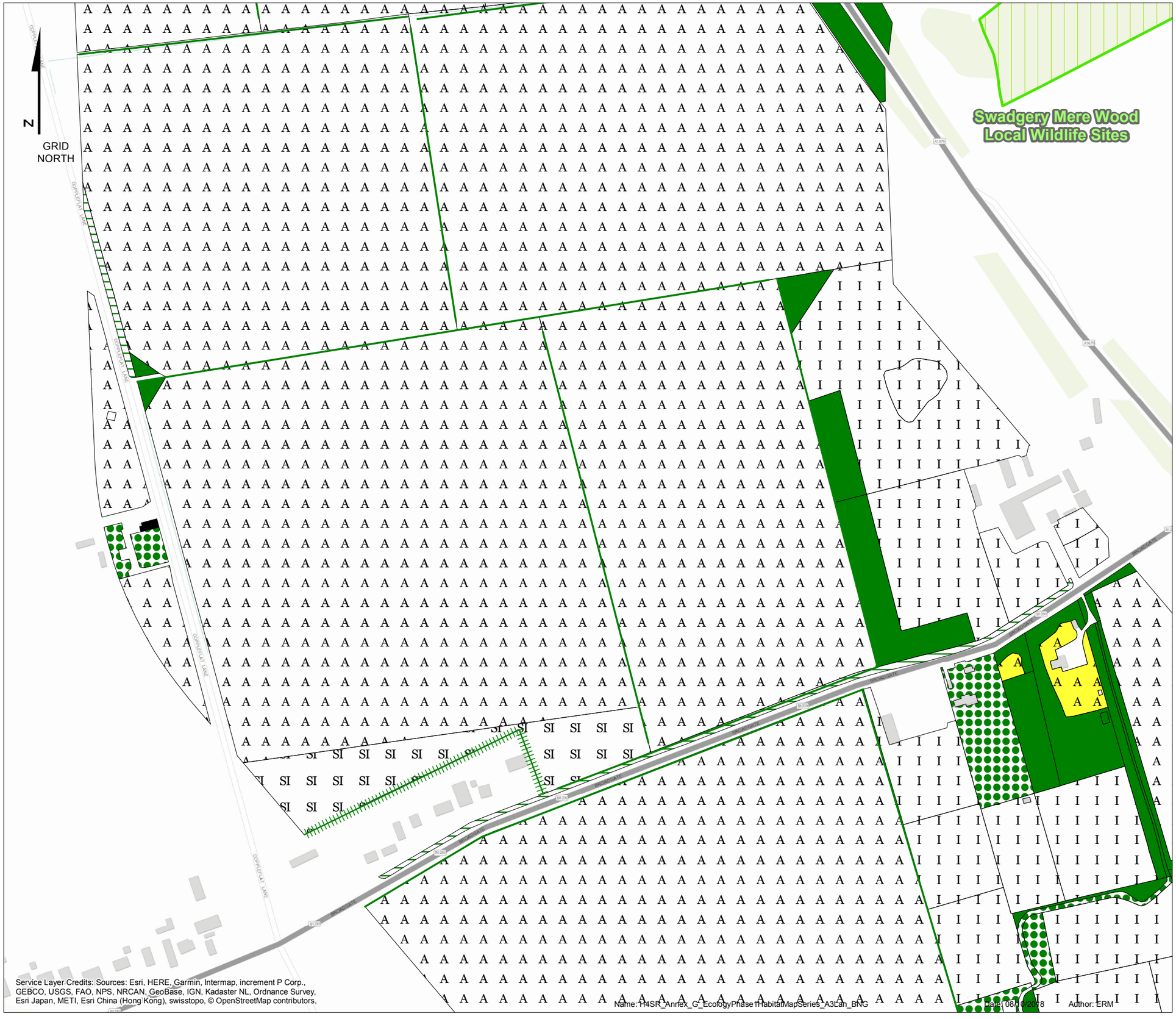
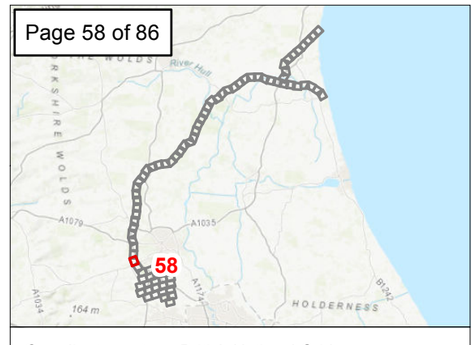


Scoping Boundary
Scoping Boundary Component
Candidate Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
B6 - Poor semi-improved grassland
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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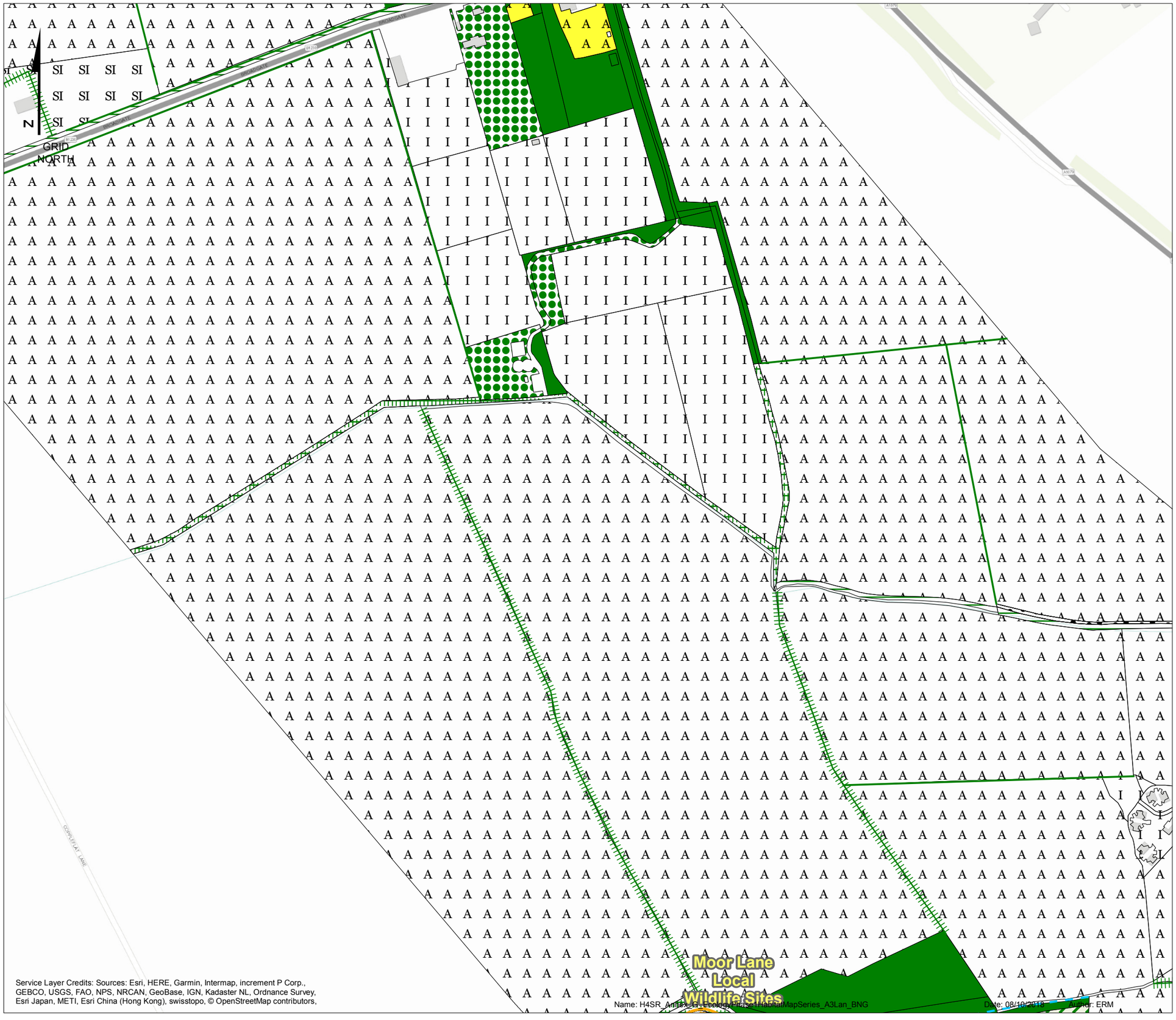
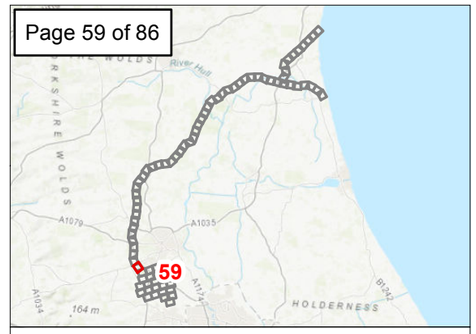
Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J2.6 - Dry ditch
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Phase 1 Habitat
Survey Map Series
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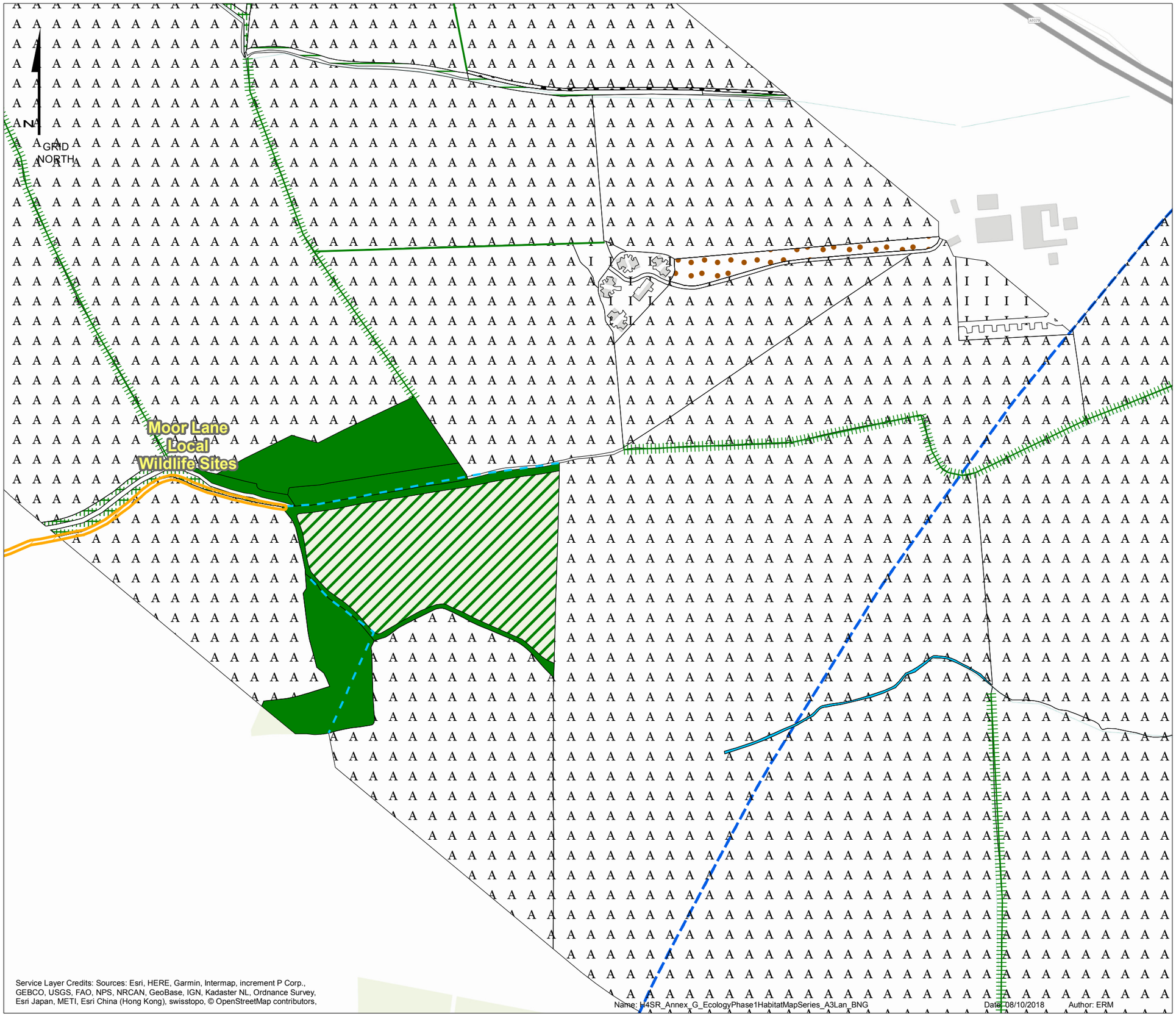
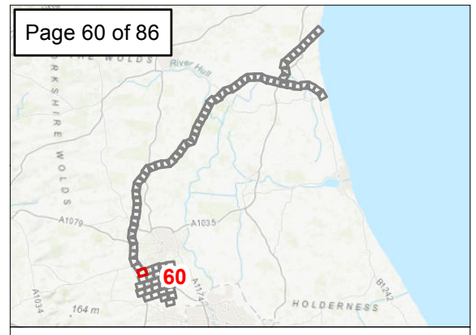
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
Designated Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
J2.6 - Dry ditch
A1.1.1 - Broadleaved woodland - semi-natural
A1.1.2 - Broadleaved woodland - plantation
B4 - Improved grassland
C3.2 - Other tall herb and fern - non ruderal
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

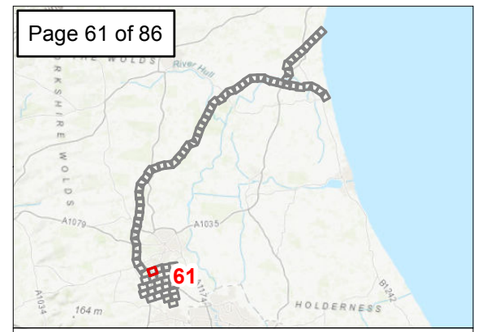
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H

N

GRID NORTH

Bentley Moor Wood Local Wildlife Sites

- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- C3.2 - Other tall herb and fern - non ruderal
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
Document no: Annex H
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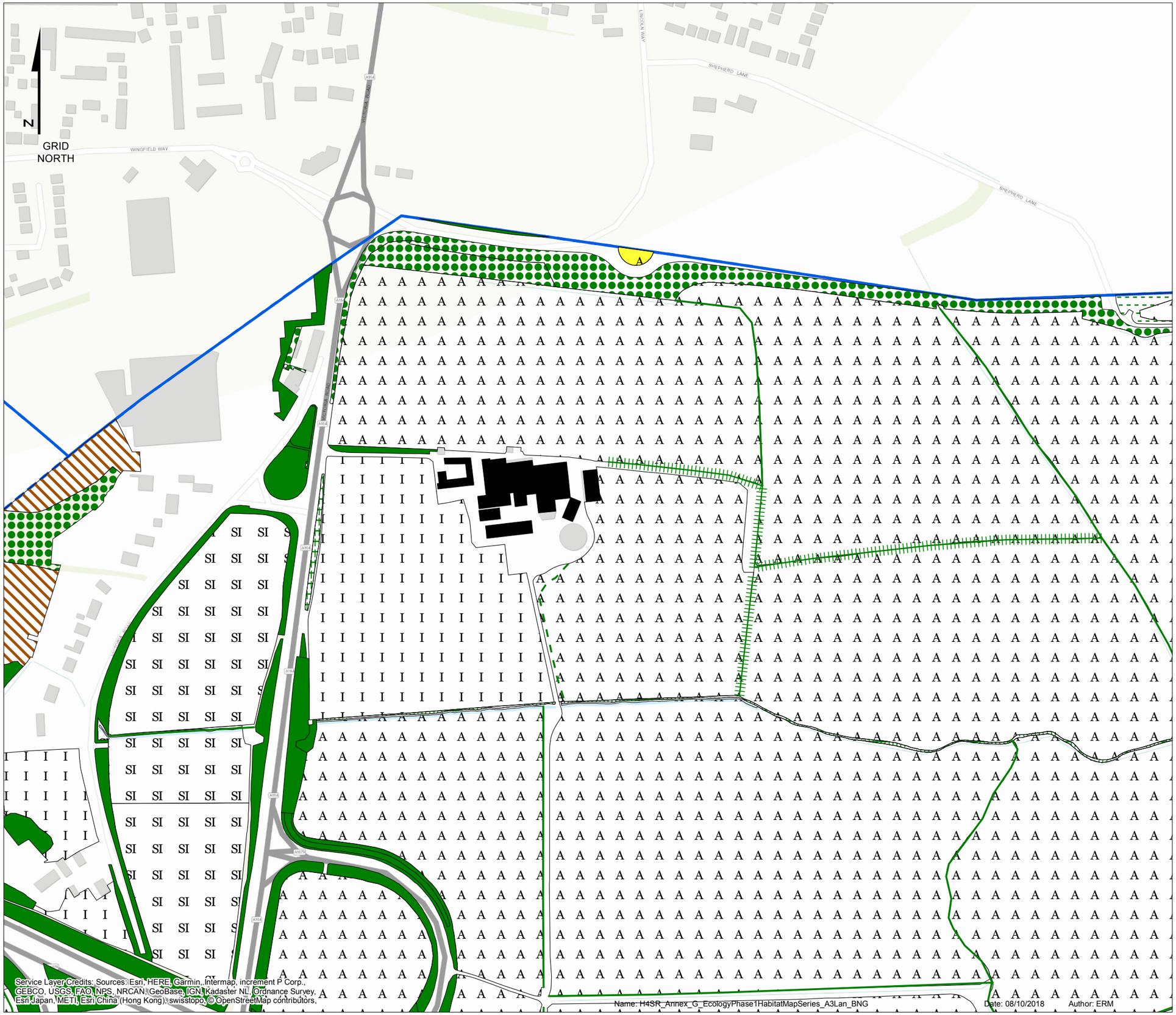
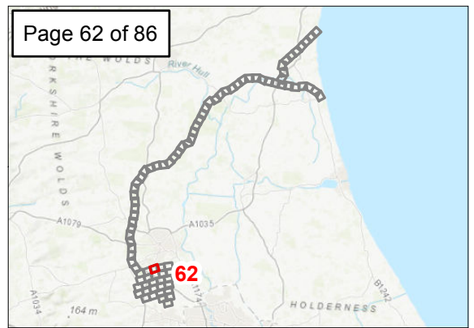
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
B6 - Poor semi-improved grassland
C3.1 - Other tall herb and fern - ruderal
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
J3.6 - Buildings



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat
Survey Map Series
Document no: Annex H
Created by: AA
Checked by: JP
Approved by: NL

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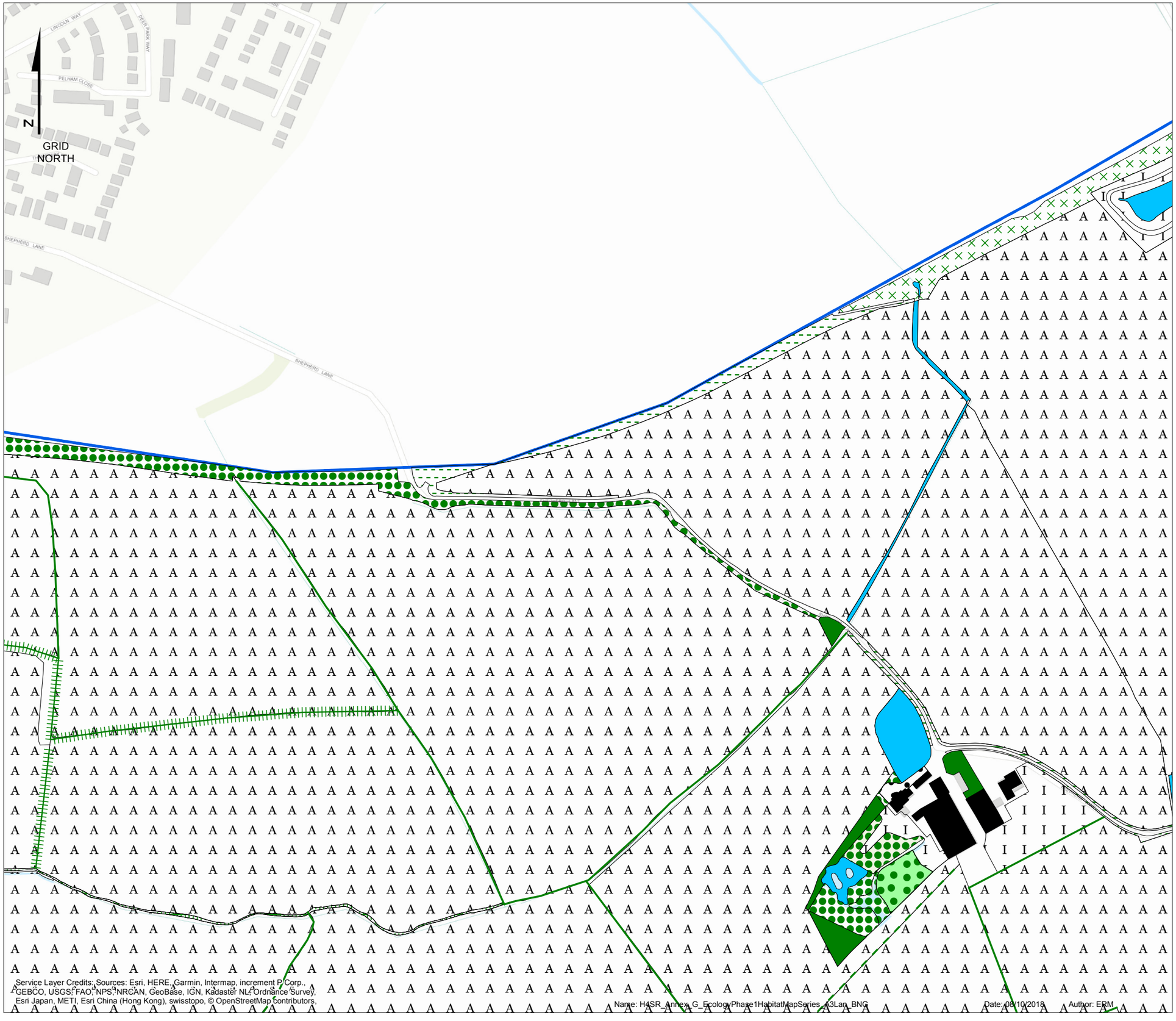
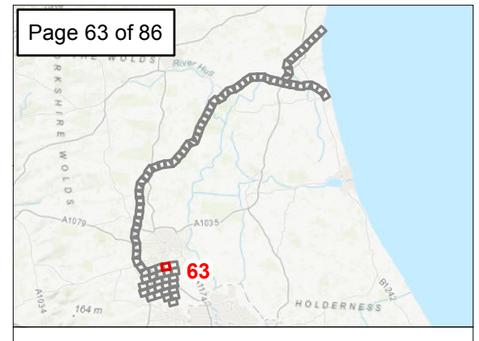
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.3.1 - Mixed woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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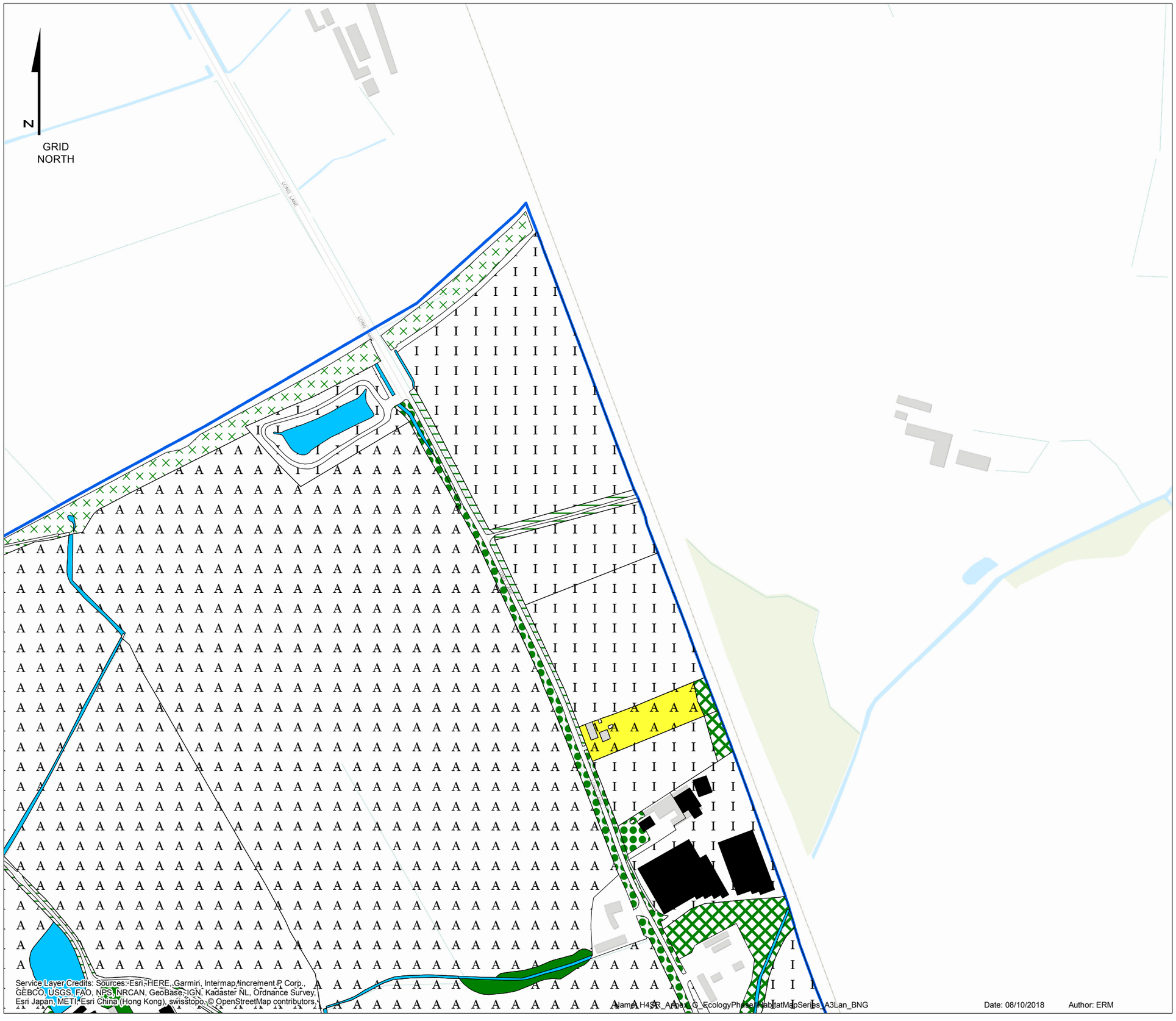
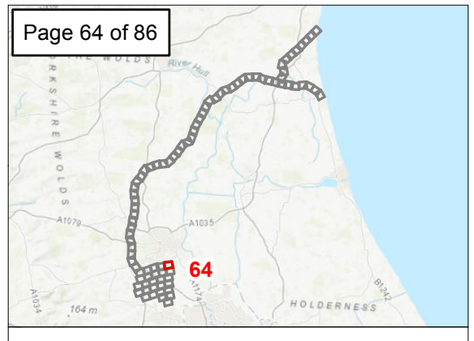


- Scoping Boundary
- Scoping Boundary Component
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors,

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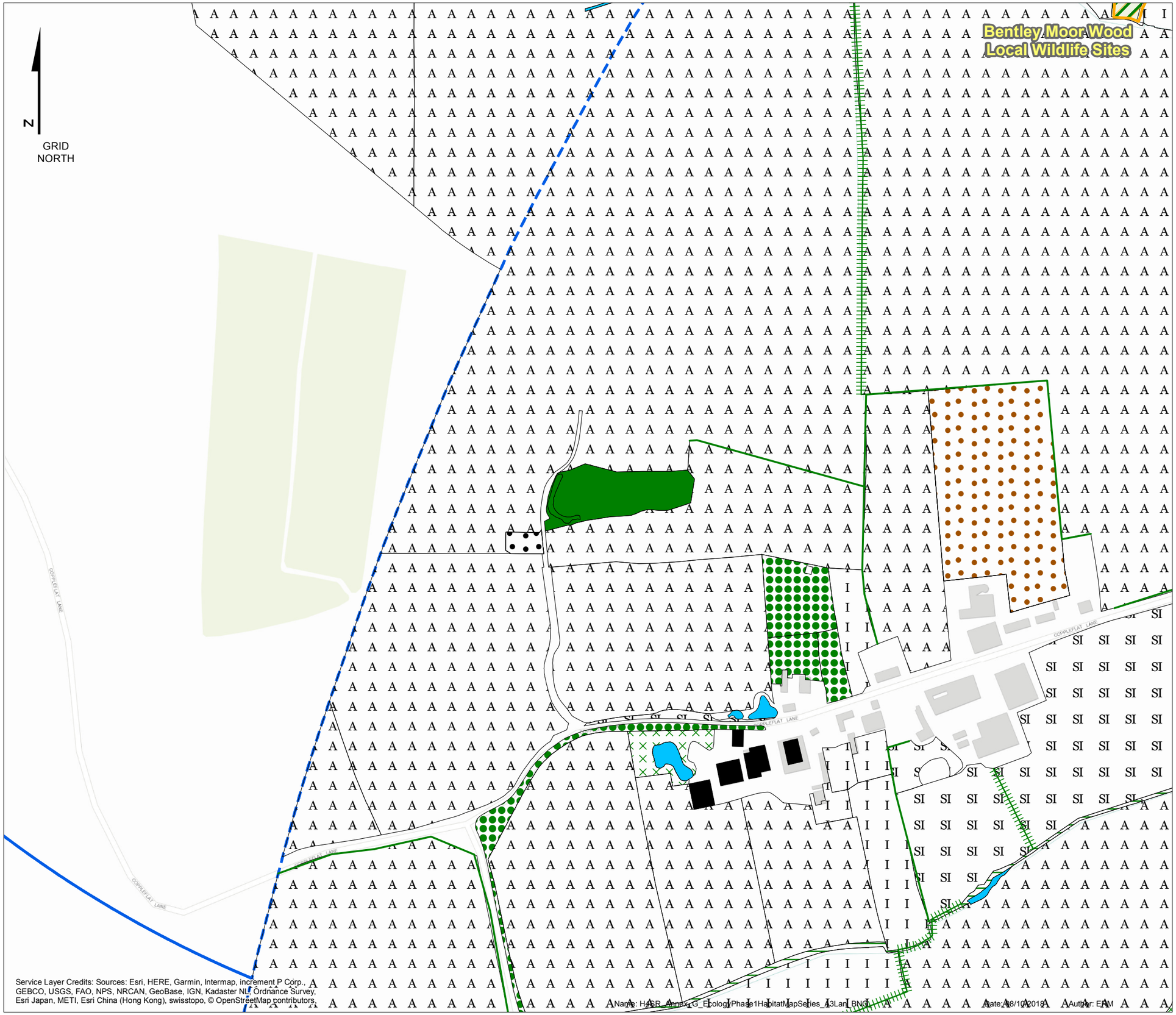
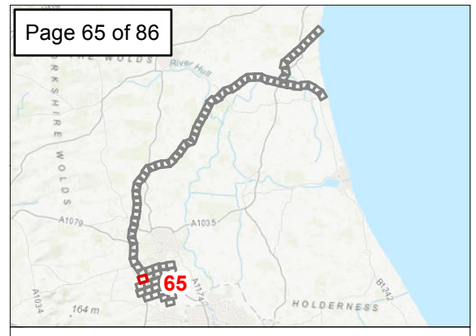


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.2 - Other tall herb and fern - non ruderal
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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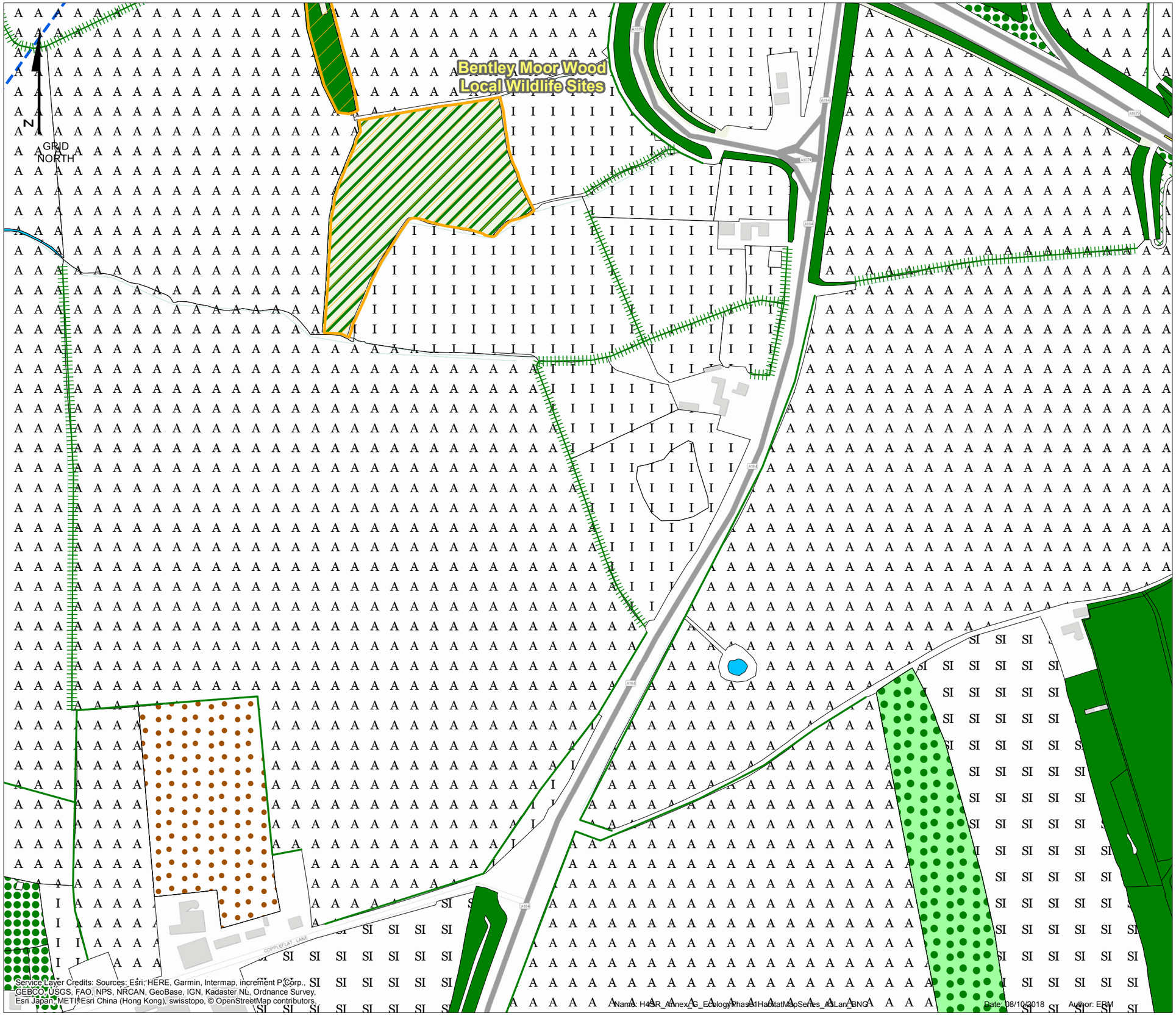
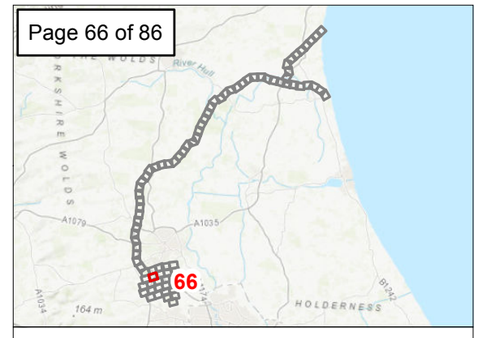


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A1.3.1 - Mixed woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.2 - Other tall herb and fern - non ruderal
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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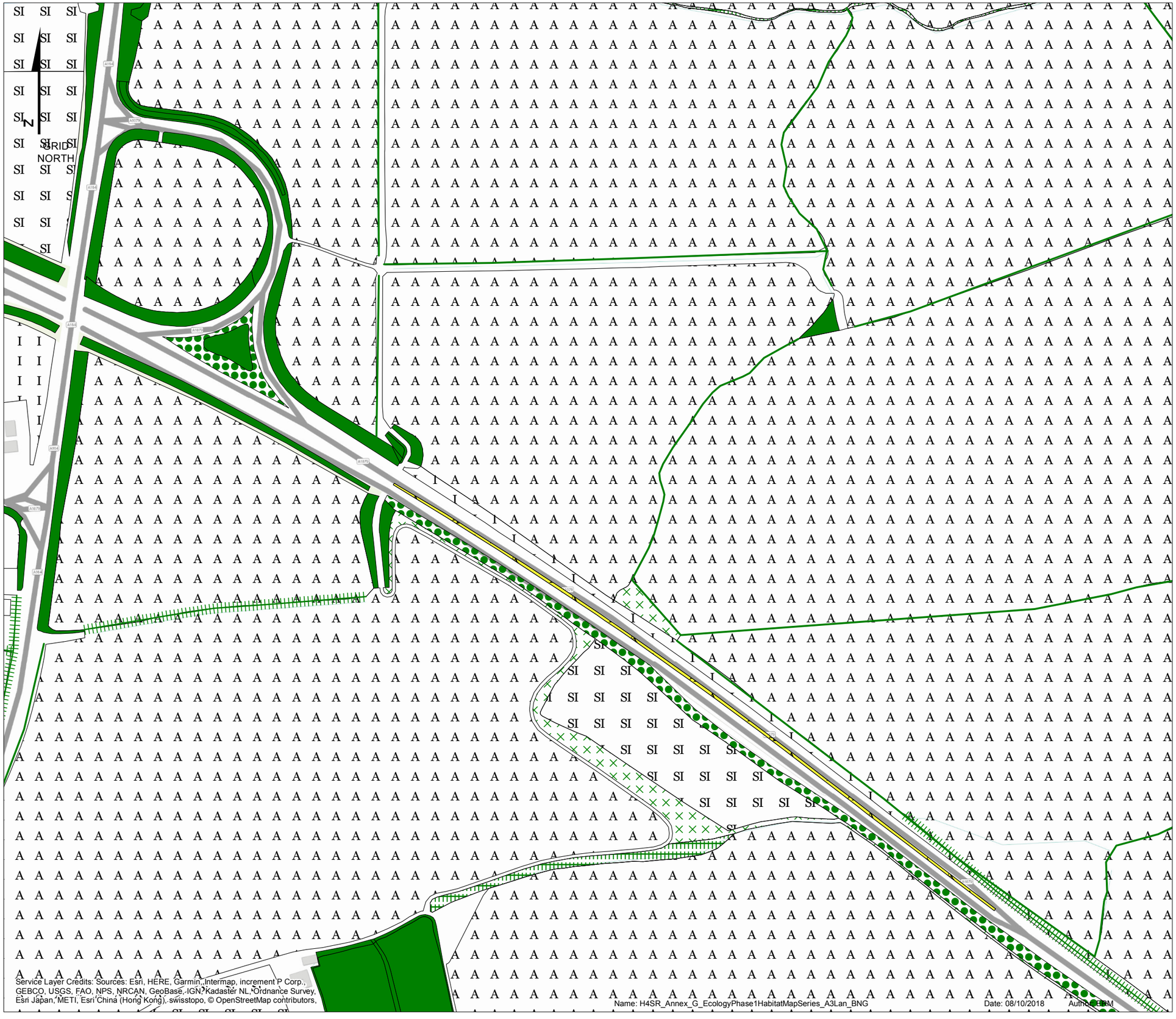
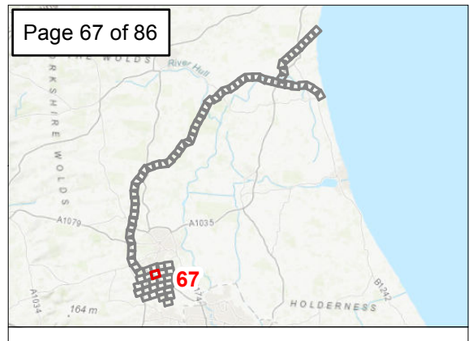


- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.3.2 - Hedge with trees - species-poor



Coordinate system: British National Grid

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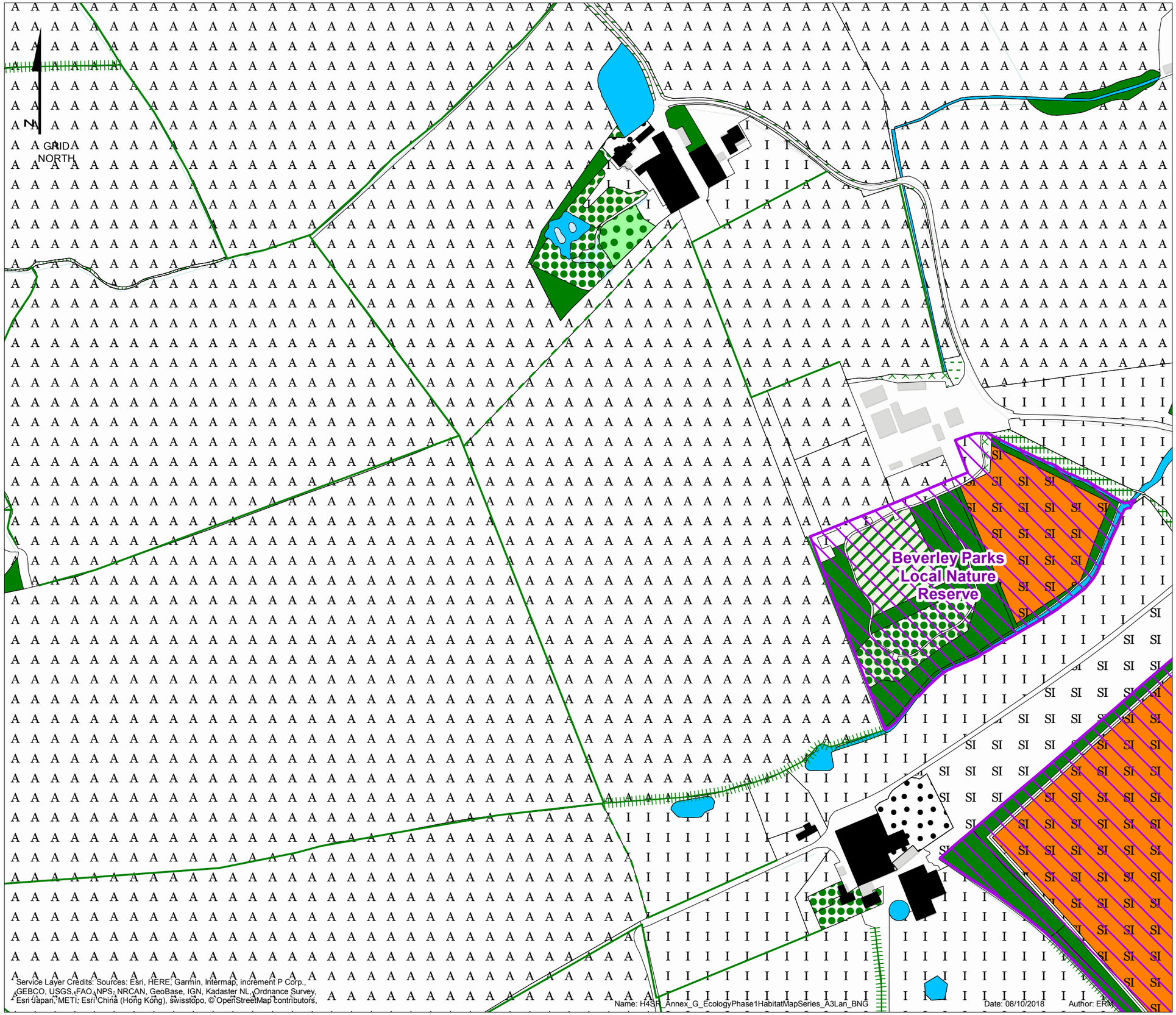
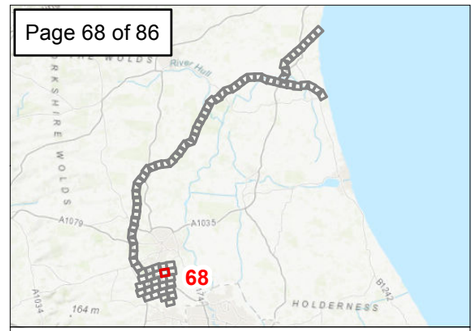


- Scoping Boundary
- Scoping Boundary Component
- Local Nature Reserve (Natural England)
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.1.2 - Broadleaved woodland - plantation
- A1.3.1 - Mixed woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B2.2 - Neutral grassland - semi-improved
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

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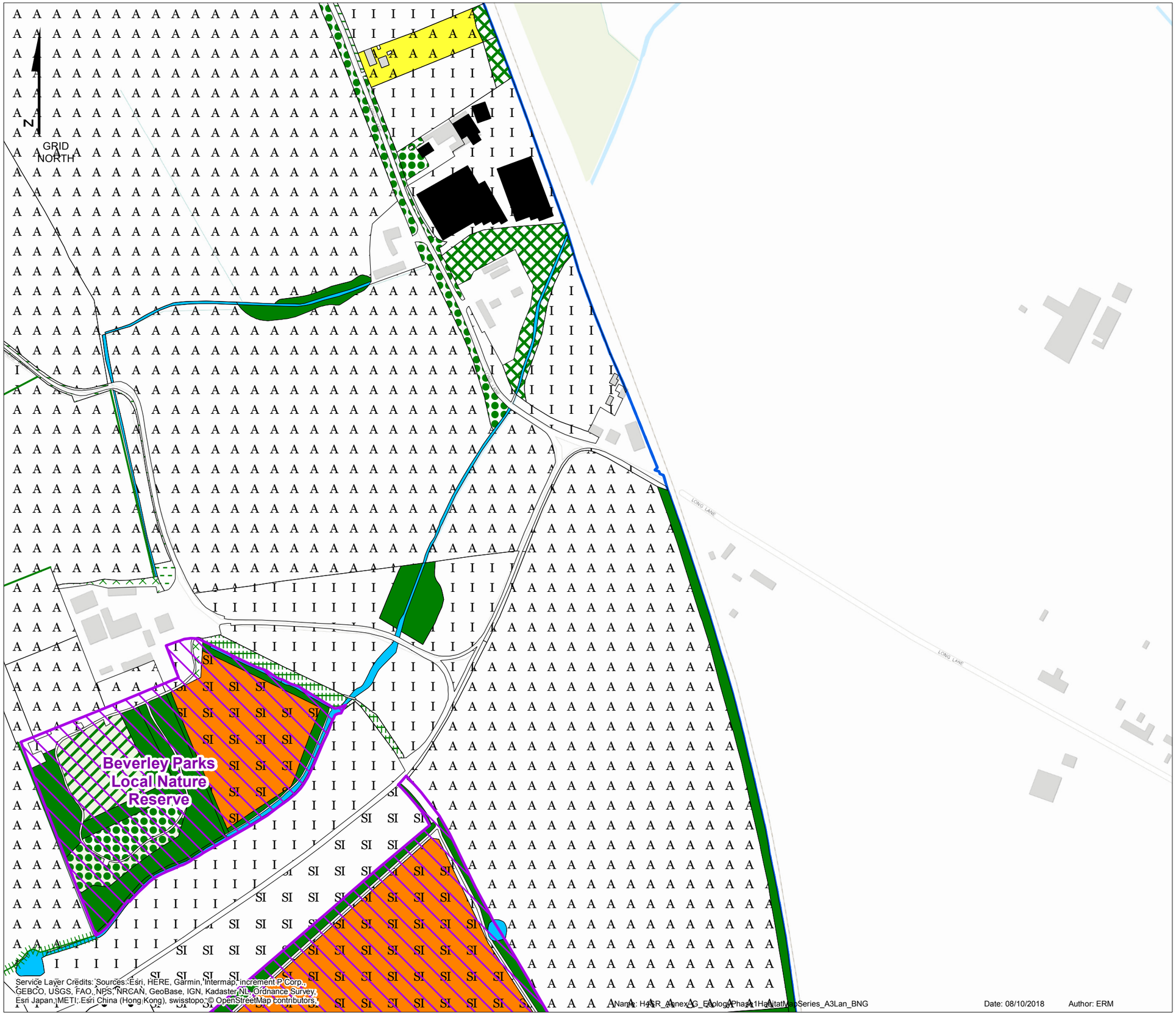
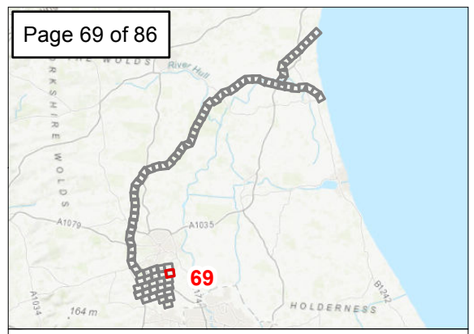


Scoping Boundary
Scoping Boundary Component
Local Nature Reserve (Natural England)
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A1.1.2 - Broadleaved woodland - plantation
A2.1 - Scrub - dense/continuous
A2.2 - Scrub - scattered
A3.1 - Broadleaved Parkland/scattered trees
B2.2 - Neutral grassland - semi-improved
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J1.2 - Cultivated/disturbed land - amenity grassland
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
J3.6 - Buildings
J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat
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N

GRID NORTH

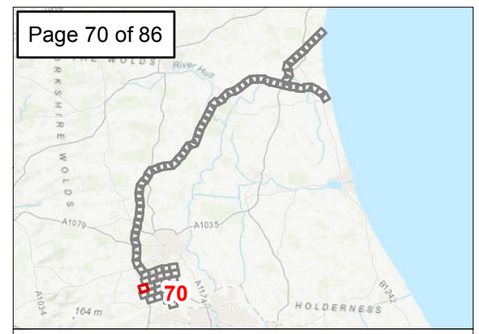
Fishpond Wood, Risby Estate Local Wildlife Sites

Risby Park Local Wildlife Sites

COPPLEFLAT LANE

DUNFLAT ROAD

- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor



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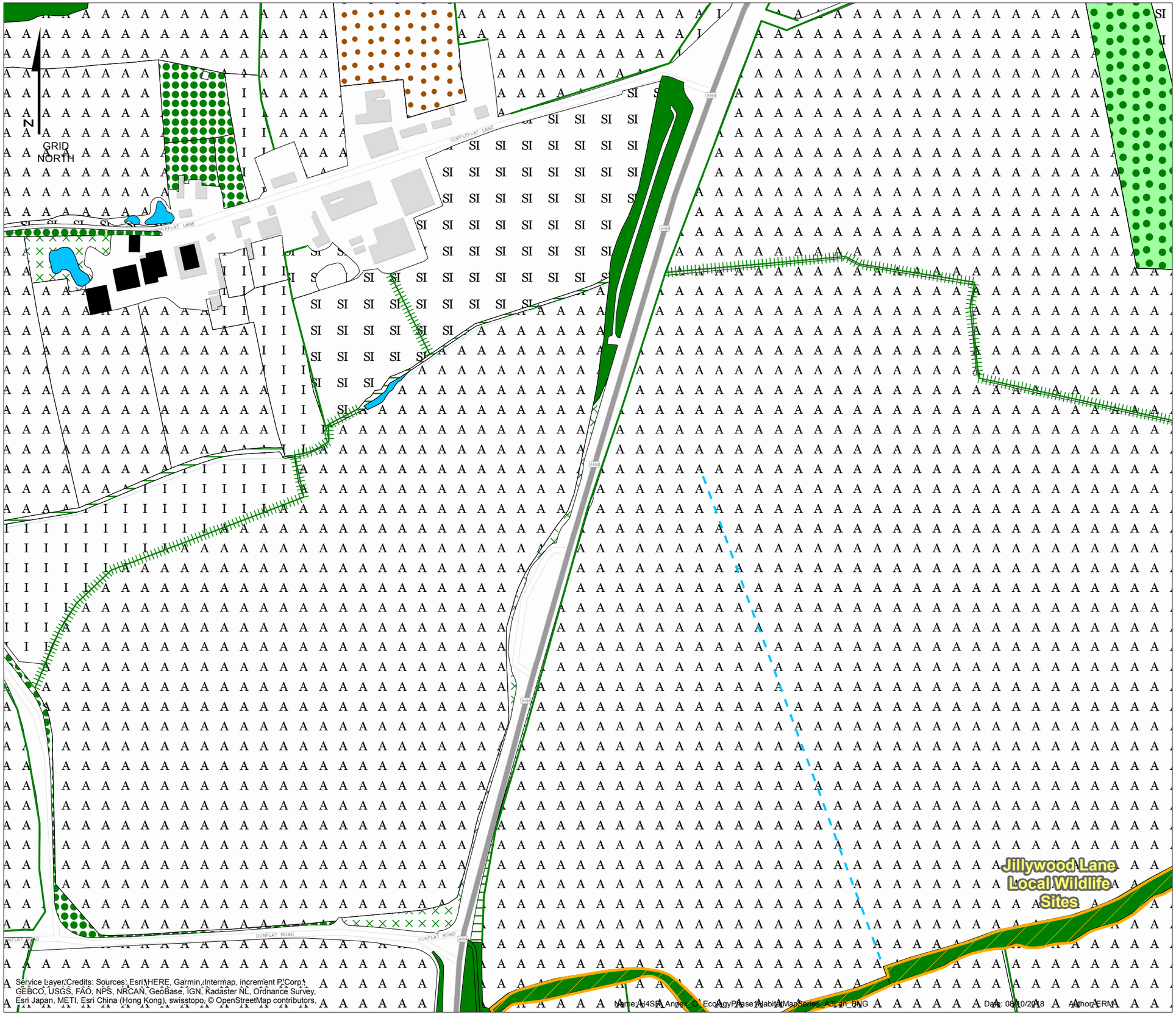
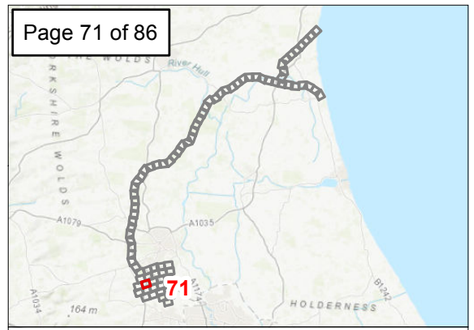


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J2.6 - Dry ditch
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.3.1 - Mixed woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.2 - Other tall herb and fern - non ruderal
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor
- J3.6 - Buildings



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0 50 100 150 200 Yards

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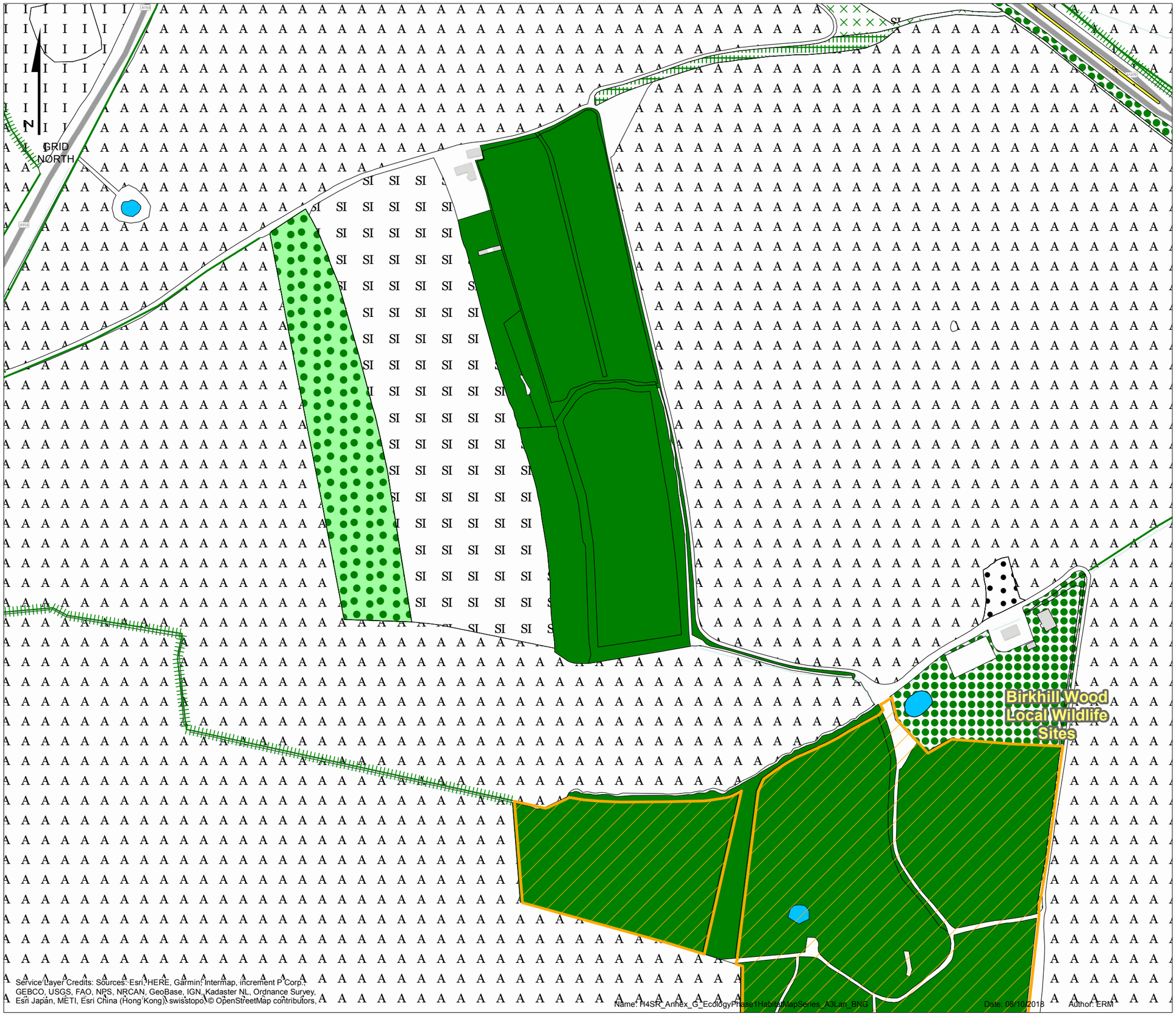
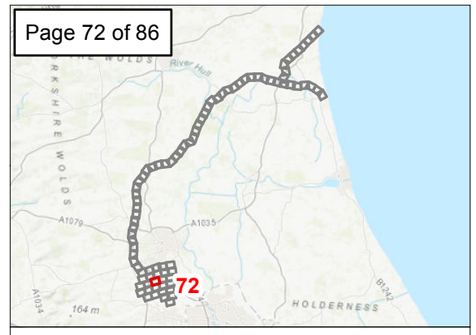


- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A1.3.1 - Mixed woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.3.2 - Hedge with trees - species-poor
- J4 - Bare ground



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0 50 100 150 200 Yards

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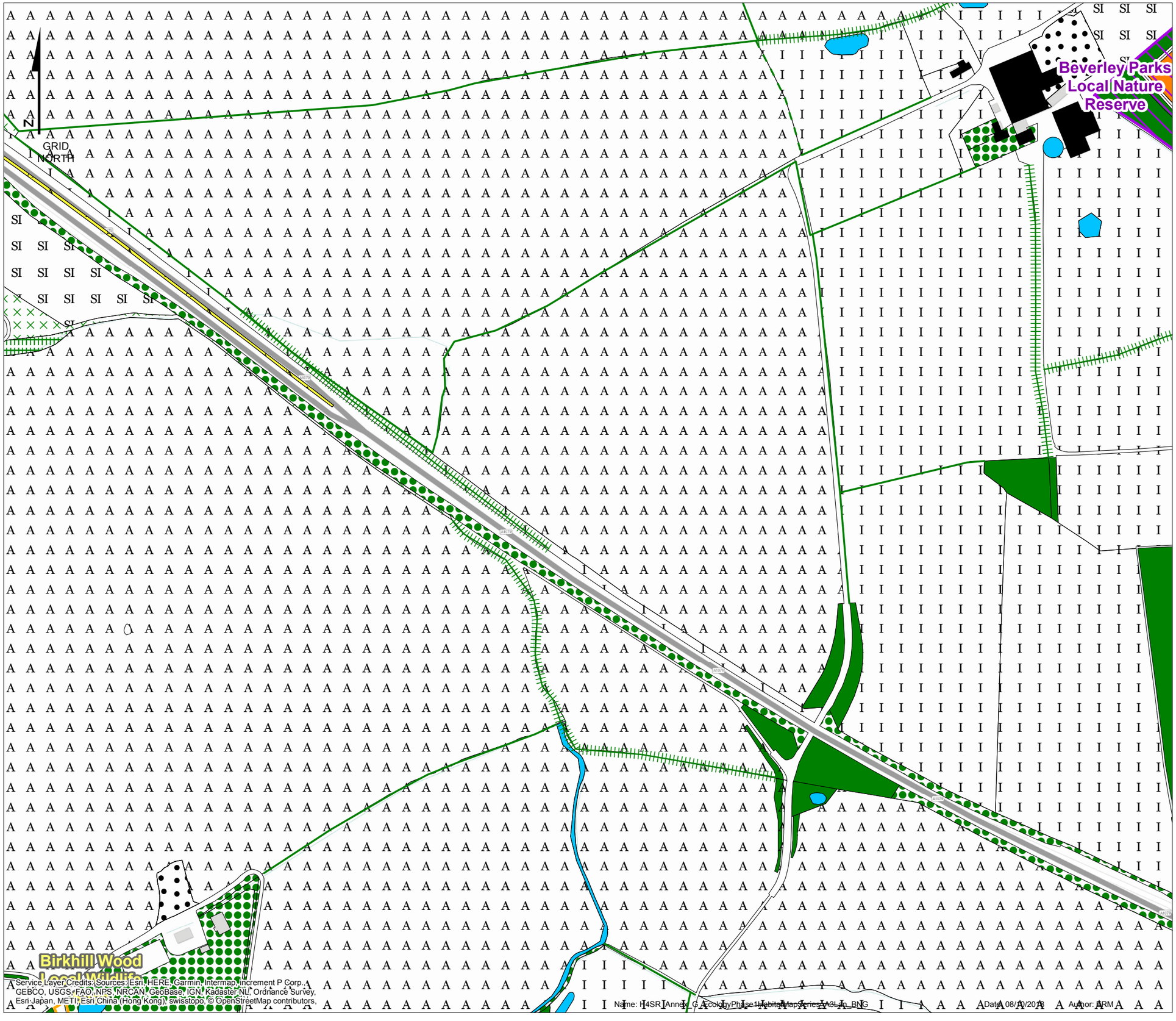
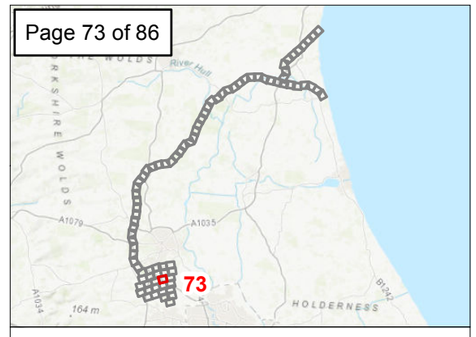
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- Local Nature Reserve (Natural England)
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B2.2 - Neutral grassland - semi-improved
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J2.3.2 - Hedge with trees - species-poor
- J3.6 - Buildings
- J4 - Bare ground



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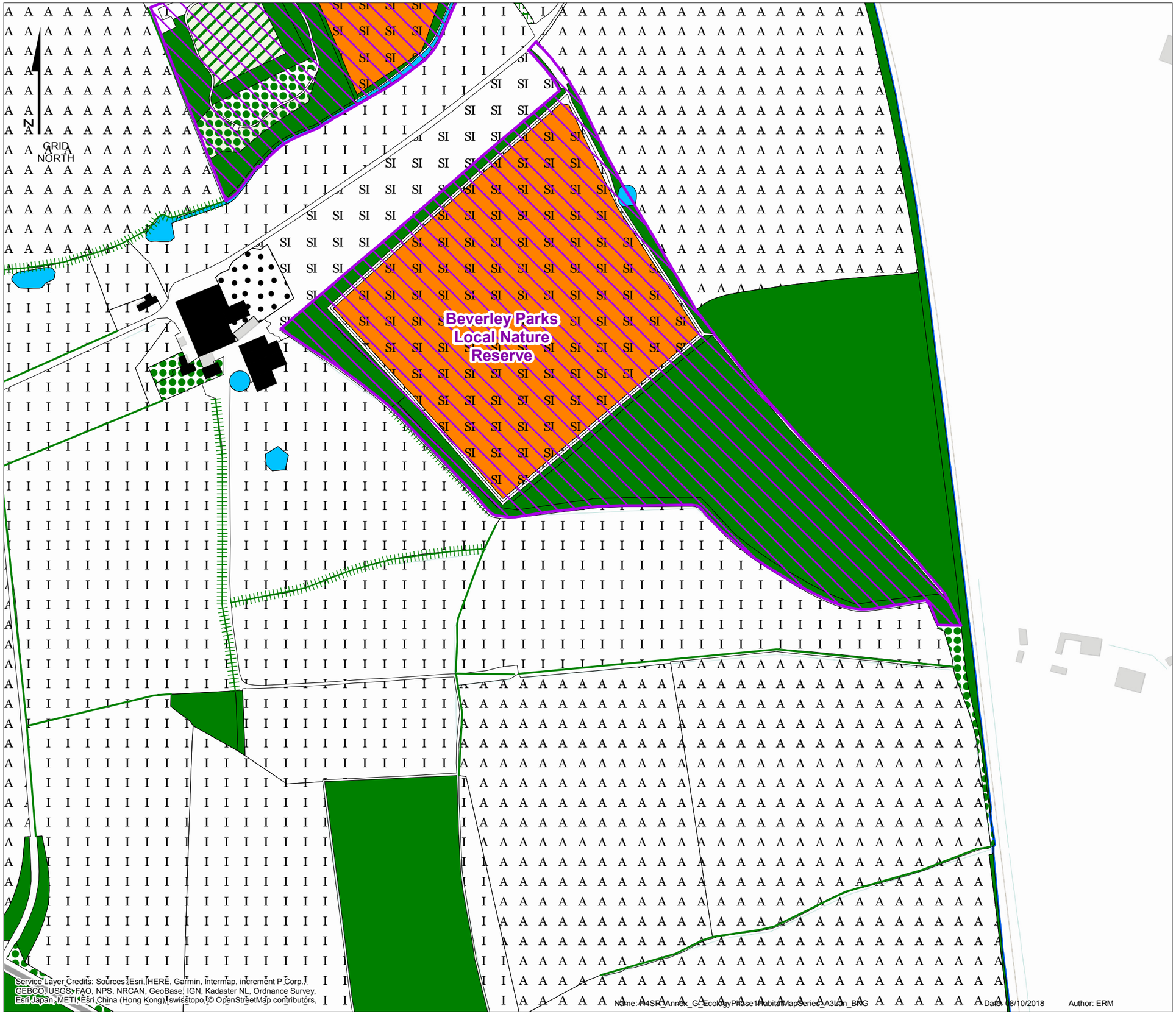
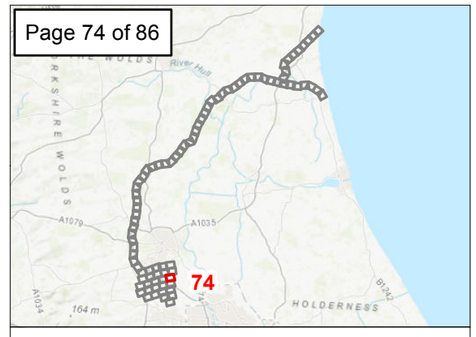


Scoping Boundary
Scoping Boundary Component
Local Nature Reserve (Natural England)
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A1.1.2 - Broadleaved woodland - plantation
A3.1 - Broadleaved Parkland/scattered trees
B2.2 - Neutral grassland - semi-improved
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable
J2.3.2 - Hedge with trees - species-poor
J3.6 - Buildings
J4 - Bare ground



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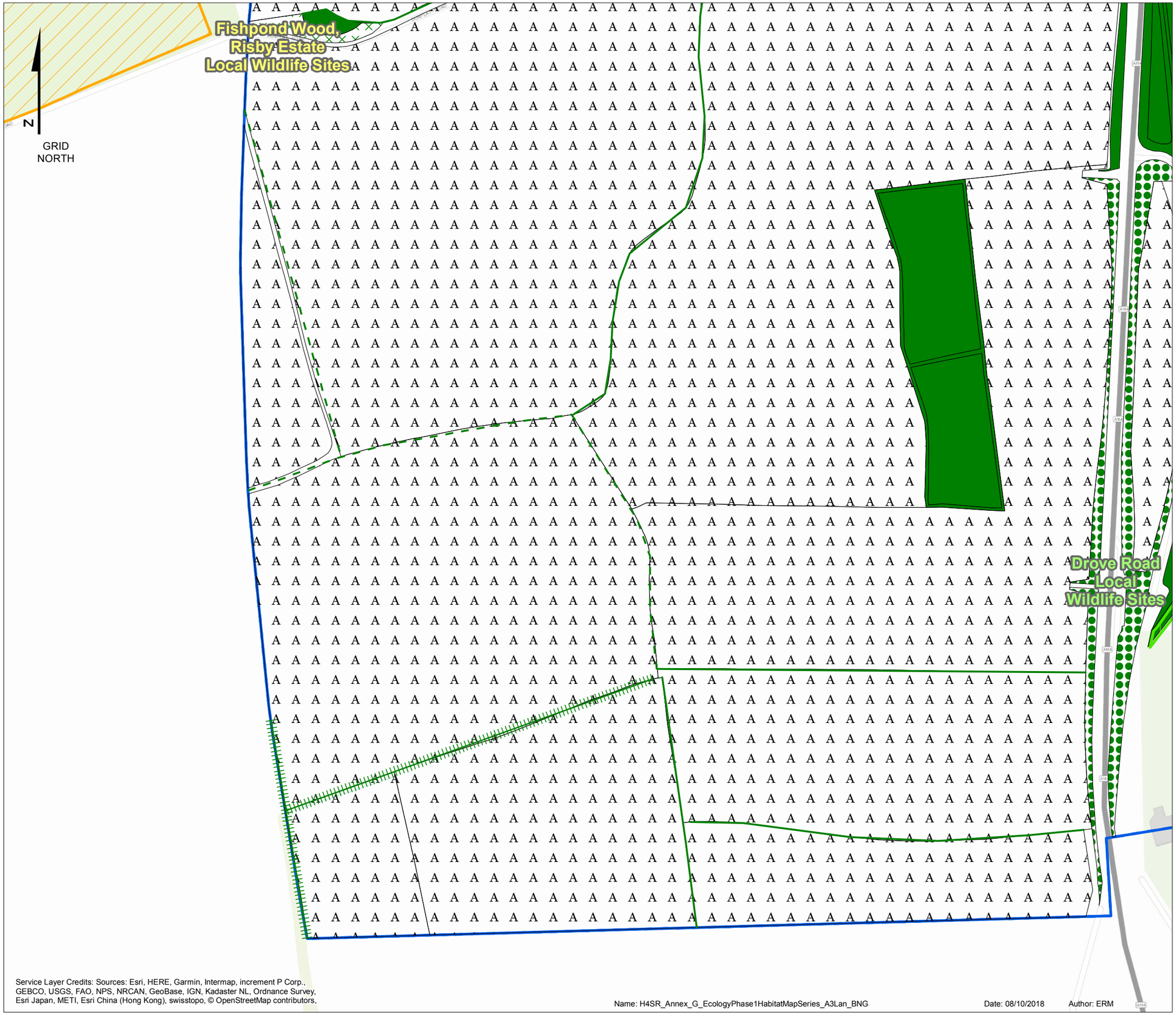
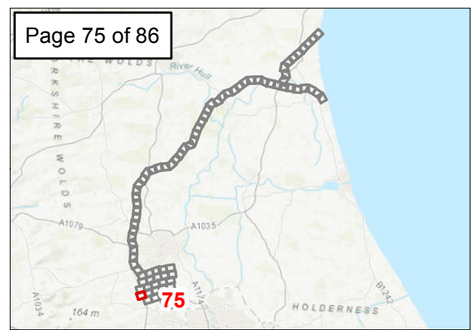


Scoping Boundary
Scoping Boundary Component
Candidate Local Wildlife Site
Designated Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
J2.2.2 - Defunct hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A2.2 - Scrub - scattered
A3.1 - Broadleaved Parkland/scattered trees
J1.1 - Cultivated/disturbed land - arable



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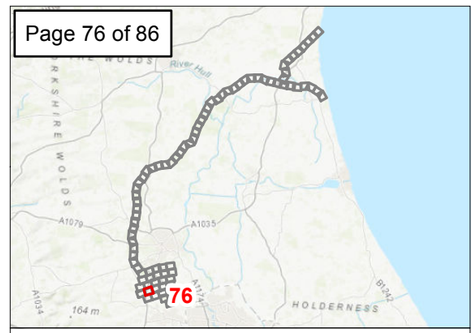
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Candidate Local Wildlife Site
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- J2.6 - Dry ditch
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- G1 - Standing water
- J1.1 - Cultivated/disturbed land - arable
- J2.1.2 - Intact hedge - species-poor



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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Checked by: JP
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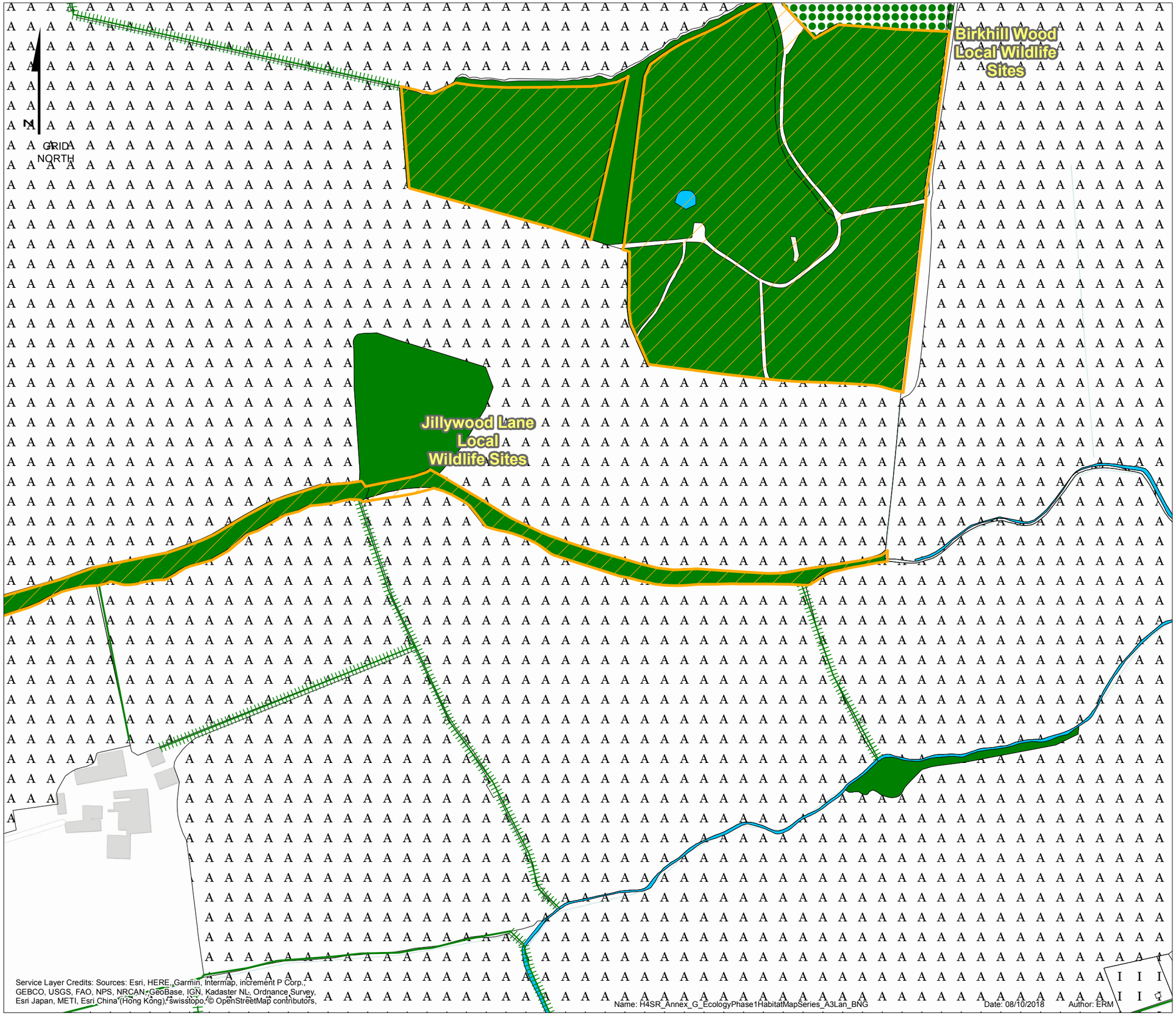
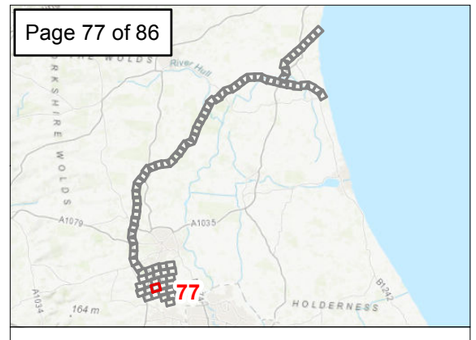
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
Designated Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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Hornsea Four
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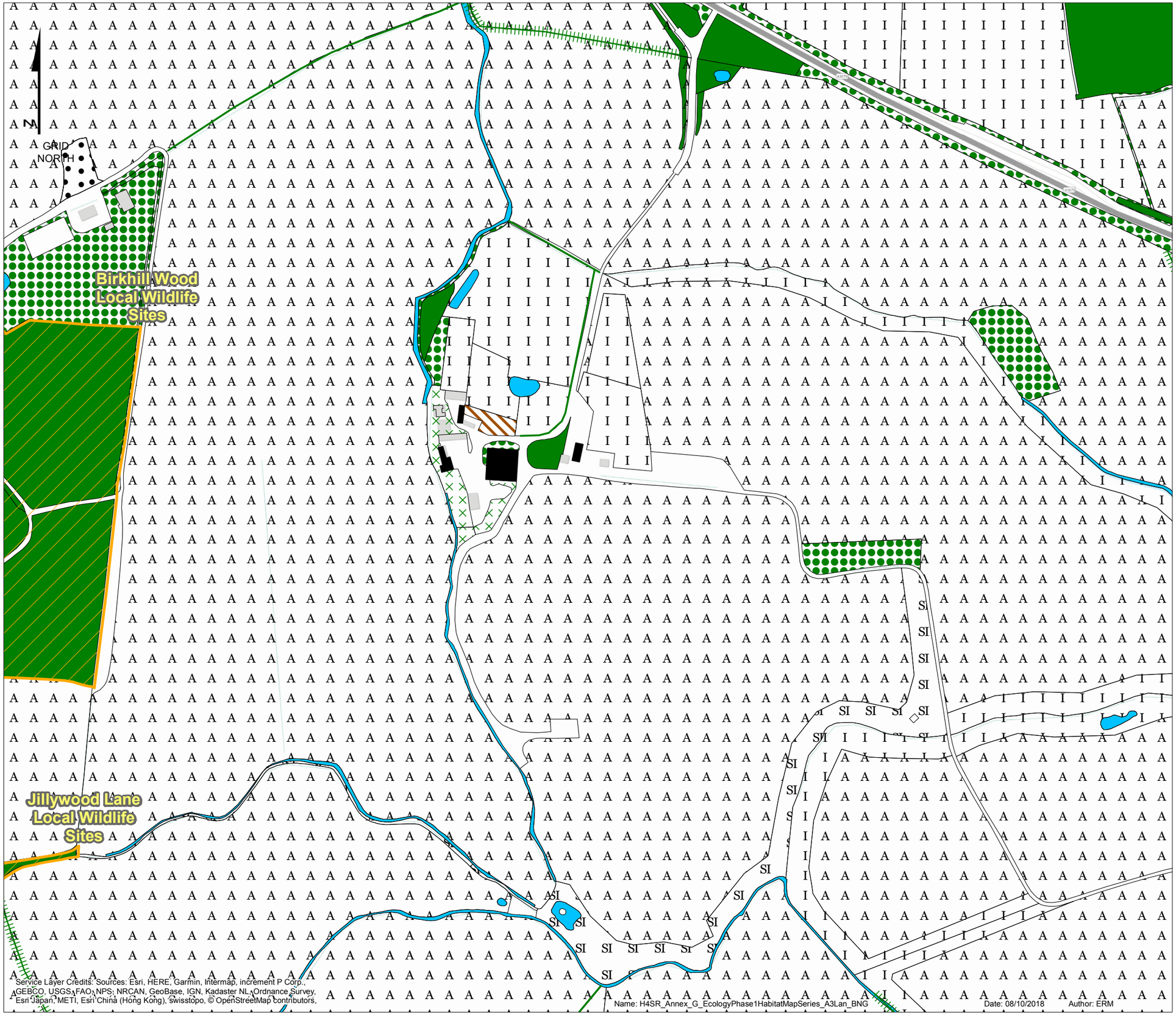
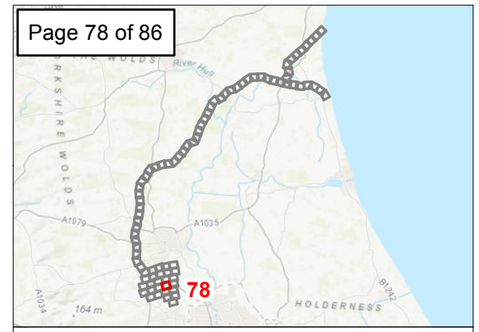
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.2 - Scrub - scattered
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- C3.1 - Other tall herb and fern - ruderal
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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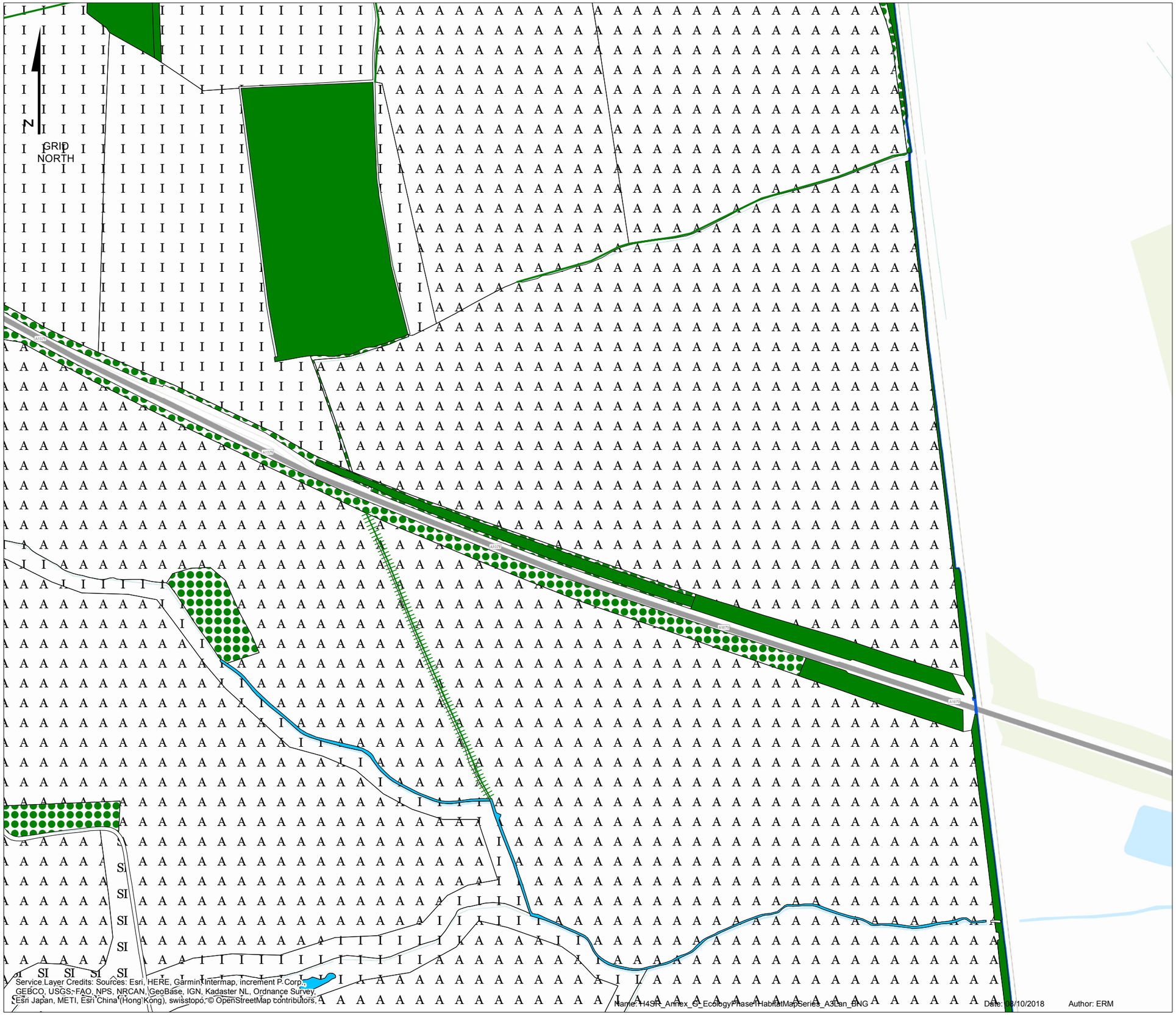
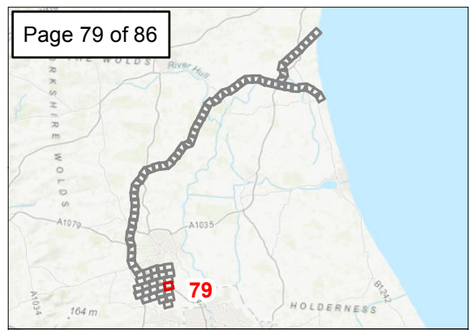
Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
B4 - Improved grassland
B6 - Poor semi-improved grassland
G1 - Standing water
G2 - Running water
J1.1 - Cultivated/disturbed land - arable



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Phase 1 Habitat
Survey Map Series
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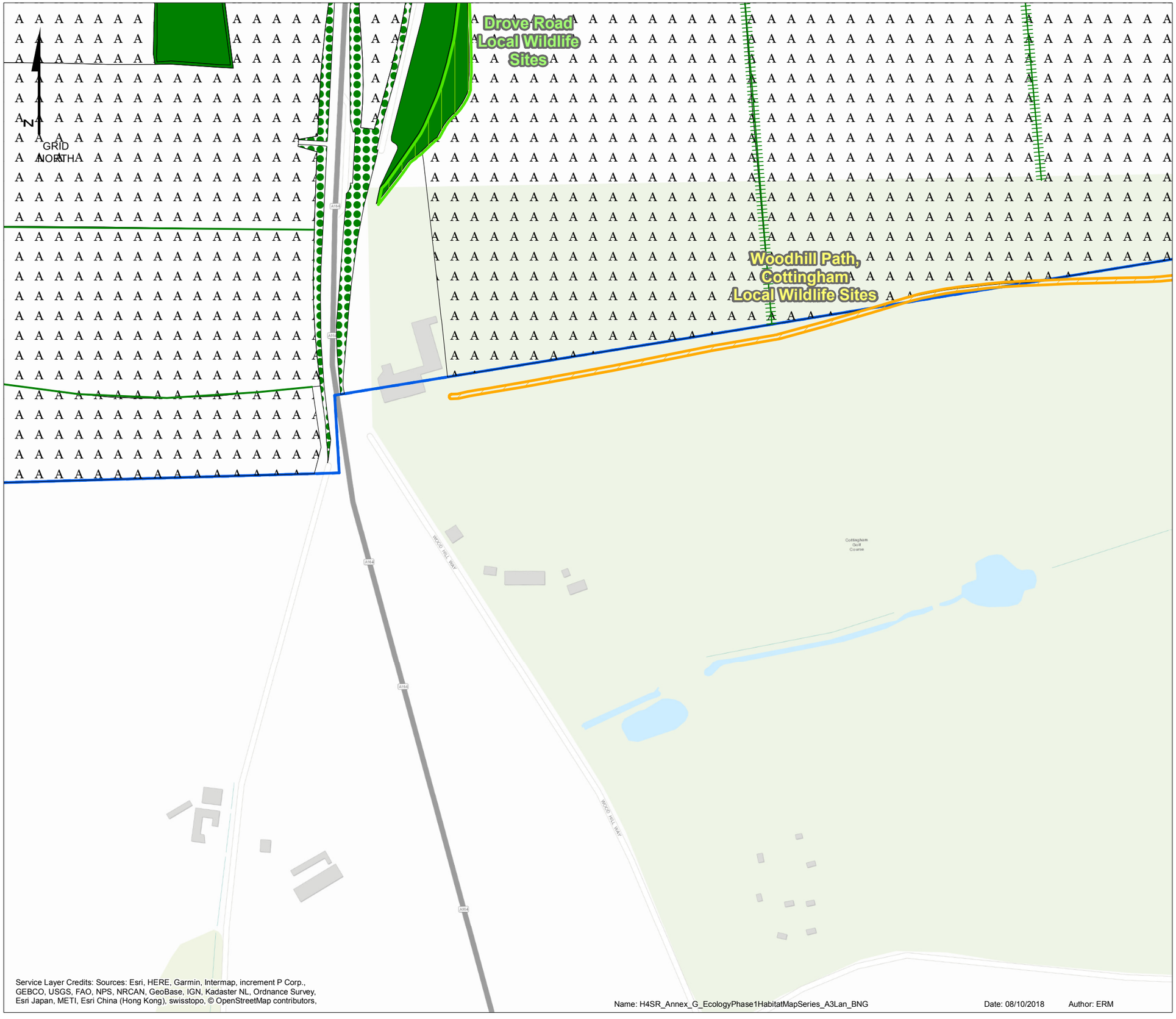
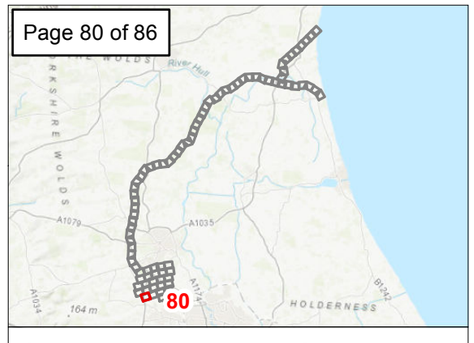
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



Scoping Boundary
Scoping Boundary Component
Candidate Local Wildlife Site
Designated Local Wildlife Site
J2.1.2 - Intact hedge - species-poor
J2.3.2 - Hedge with trees - species-poor
A1.1.1 - Broadleaved woodland - semi-natural
A3.1 - Broadleaved Parkland/scattered trees
J1.1 - Cultivated/disturbed land - arable



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
Document no: Annex H
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Checked by: JP
Approved by: NL

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Phase 1 Habitat Survey Map Series
Annex H

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GRID NORTH

Woodhill Path, Cottingham Local Wildlife Sites

Cottingham Golf Course

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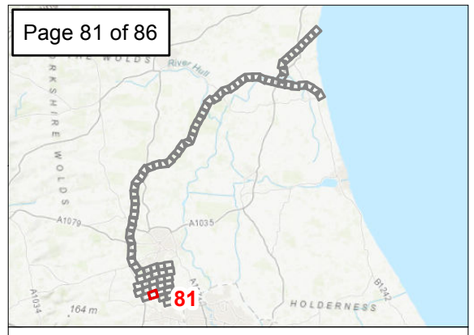
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG

Date: 08/10/2018

Author: ERM

- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- B4 - Improved grassland
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

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Checked by: JP
Approved by: NL

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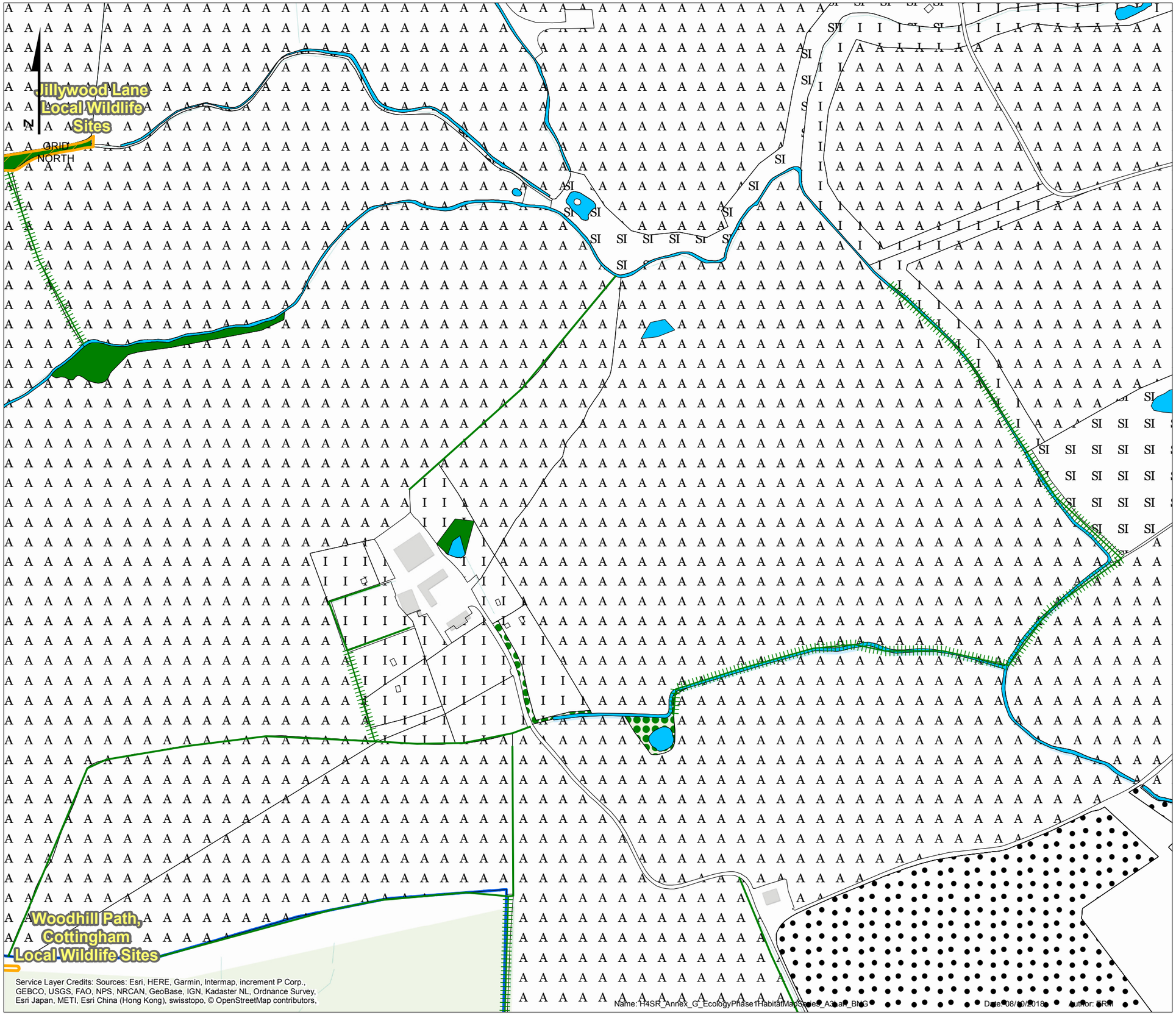
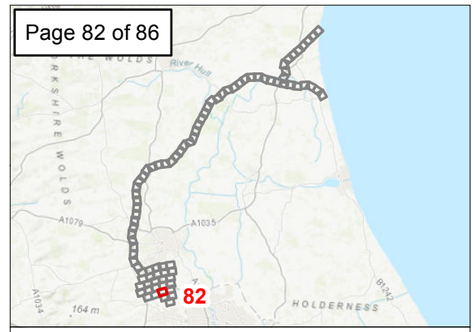
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Designated Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

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0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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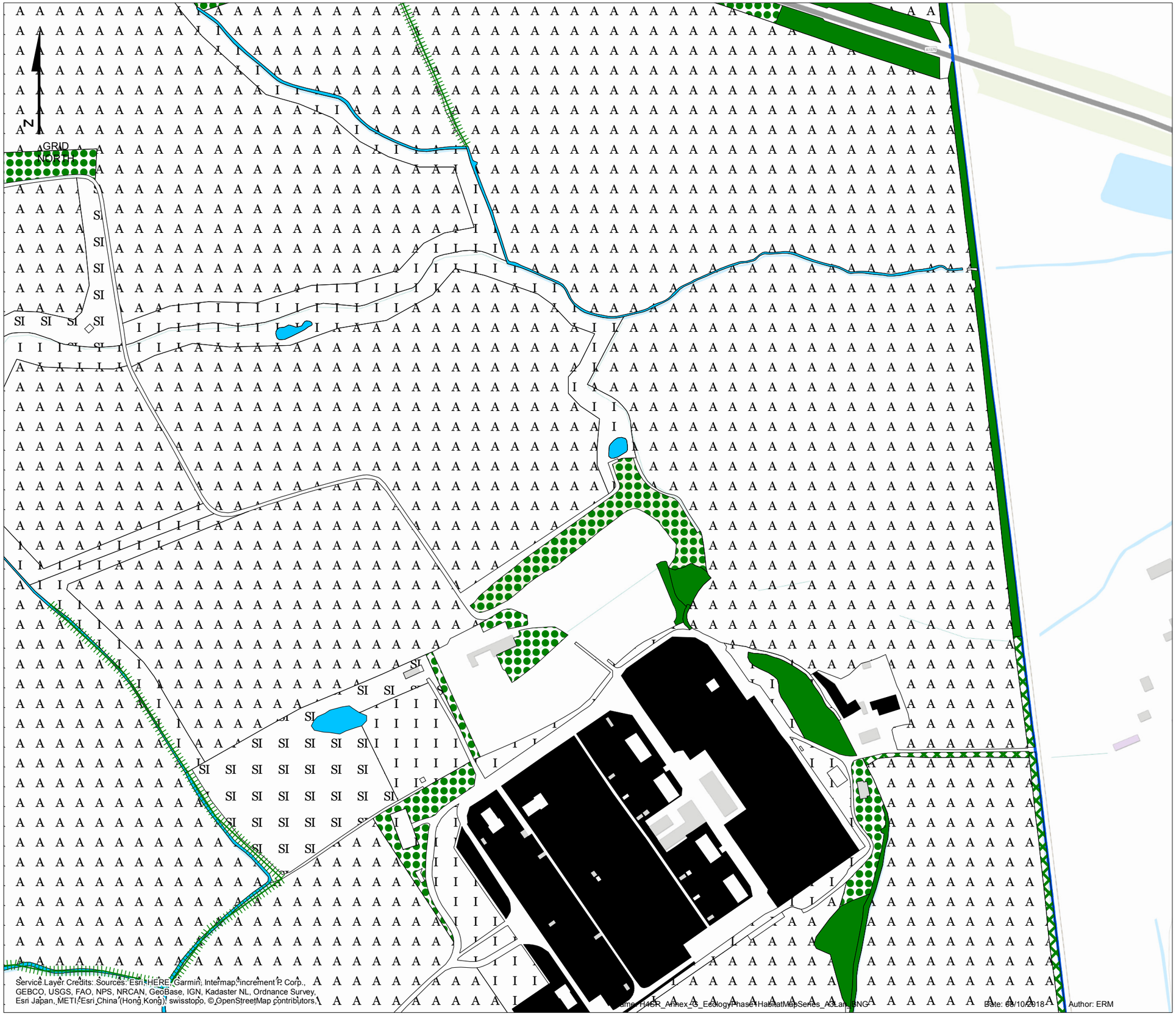
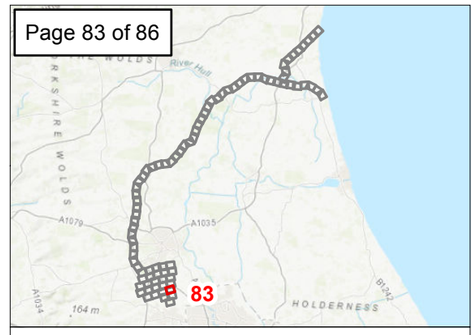
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J3.6 - Buildings



Coordinate system: British National Grid

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0 50 100 150 200 Meters

0 50 100 150 200 Yards

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Hornsea Four
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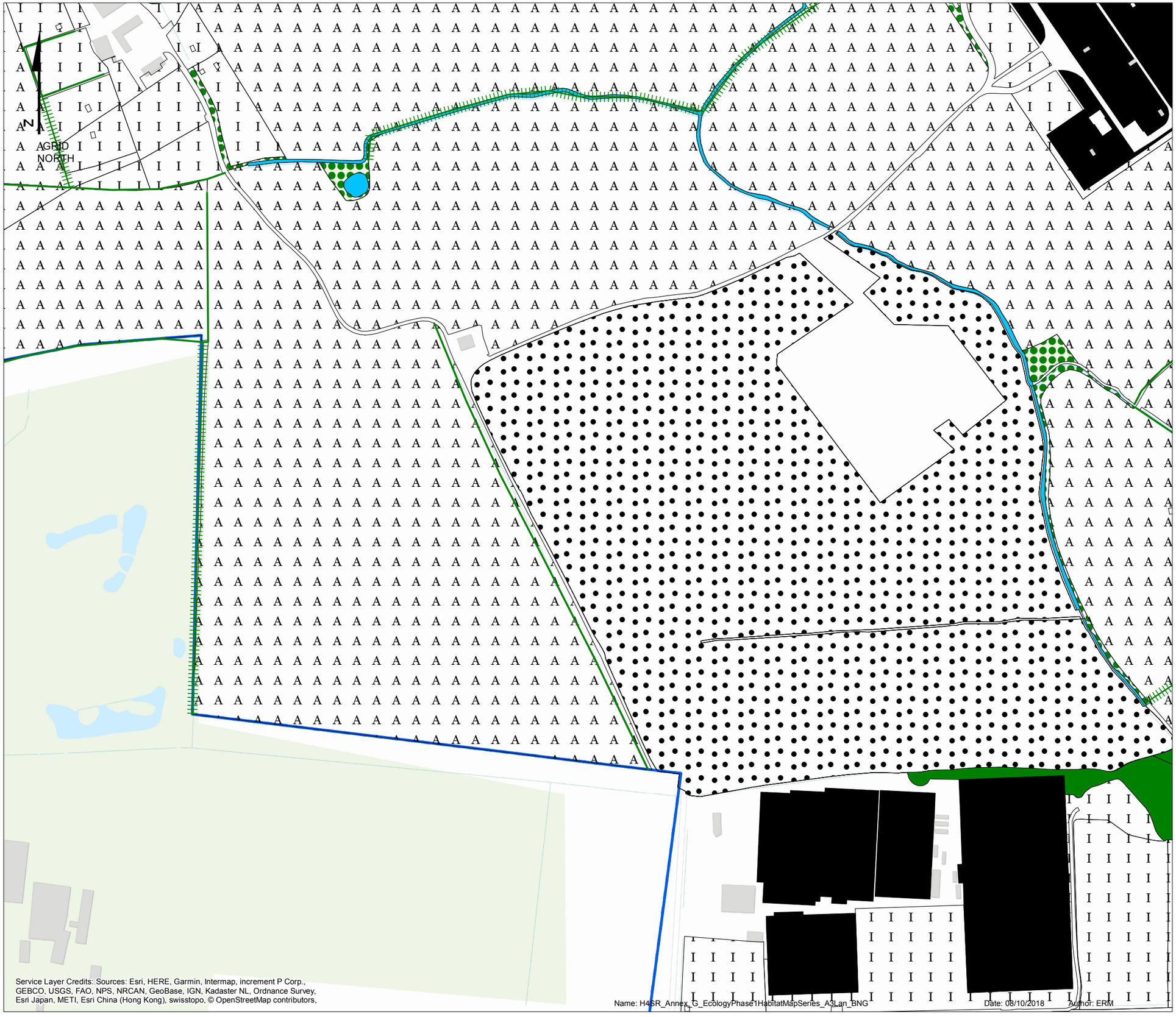
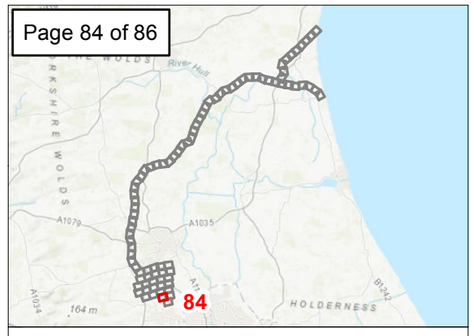
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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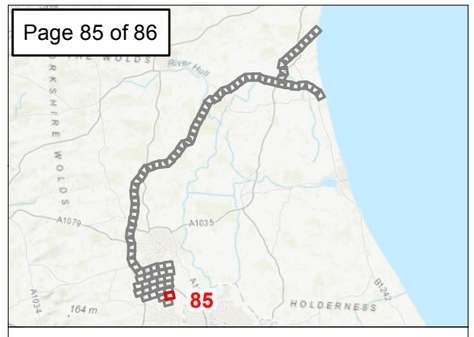
Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

Hornsea Four
Phase 1 Habitat Survey
Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- J2.1.2 - Intact hedge - species-poor
- J2.2.2 - Defunct hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J3.6 - Buildings
- J4 - Bare ground



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0 50 100 150 200 Yards

Phase 1 Habitat
Survey Map Series
Document no: Annex H
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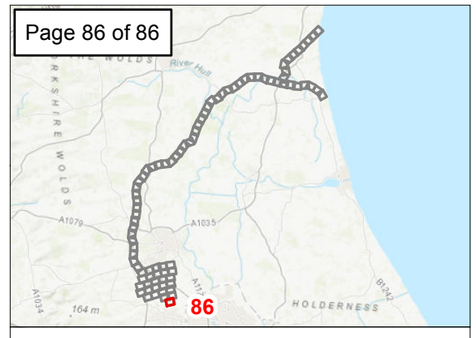
Hornsea Four
Phase 1 Habitat Survey Map Series
Annex H



- Scoping Boundary
- Scoping Boundary Component
- Candidate Local Wildlife Site
- J2.1.2 - Intact hedge - species-poor
- J2.3.2 - Hedge with trees - species-poor
- A1.1.1 - Broadleaved woodland - semi-natural
- A2.1 - Scrub - dense/continuous
- A3.1 - Broadleaved Parkland/scattered trees
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- G1 - Standing water
- G2 - Running water
- J1.1 - Cultivated/disturbed land - arable
- J1.2 - Cultivated/disturbed land - amenity grassland
- J3.6 - Buildings
- J4 - Bare ground



Coordinate system: British National Grid

Scale@A3: 1:3250

0 50 100 150 200 Meters

0 50 100 150 200 Yards

Phase 1 Habitat Survey Map Series
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Name: H4SR_Annex_G_EcologyPhase1HabitatMapSeries_A3Lan_BNG Date: 08/10/2018 Author: ERM

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Environmental Impact Assessment: Scoping Report

Annex I Designated and Non-designated Heritage Assets Map Book

Hornsea Project

Designated heritage assets identified within the scoping area

Annex I

Key	Listed Building	Grade
1	Church of All Saints	I
2	Church of St Catherine	I
3	Church of St Leonard	I
4	Cross Base East Church of St Andrew	II
5	Woodhouse Farmhouse	II
6	51, Sands Lane	II
7	Church of St James	II
8	Manor House	II
9	Barn at Low Hall	II
10	Old Hall	II
11	1, Arram Road	II
12	Cart-Shed at Rectory Farmhouse	II
13	White House Farm	II
14	Rectory Farmhouse and Wing Walls	II
15	Killingwoldgraves	II
16	White Hall	II
17	Barmston House	II
18	Cattle Shed to Manor Farmhouse	II
19	Church House	II
20	Manor Farmhouse	II
21	The Old Joiners' Shop and Adjoining Barn	II
22	Church of St Andrew	II
23	Garden Walls at Low Hall	II
24	Pantiles	II
25	Manor Farmhouse	II
26	Mill Farmhouse	II
27	Former Lockington Railway Station	II
28	Gate Piers at Low Hall Farm	II
29	WWI Pillbox (Ba10) Auburn Farm	II
30	WWI Pillbox (Ba19), Auburn Farm	II
31	WWI Pillbox (Ba22), Auburn Farm	II
32	WWI Pillbox (Ba30A), Auburn Farm	II
33	WWI Pillbox (Ba30B), Auburn Farm	II
34	Old Hall	II*
35	Church of St Andrew	II*

Key	Scheduled Monument Name
1	Rotsea Medieval Settlement
2	Moated Site and Two Fishponds
3	Medieval Complex at Barmston Old Hall
4	Moated Site of Leconfield Castle
5	Moated Site North of Parkhouse Farm
6	Skipsea Castle
7	Beverley Sanctuary Limit Stone, Bishop Burton Cross
8	Beverley Sanctuary Limit Stone, Bentley Cross
9	Beverley Sanctuary Limit Stone, Walkington Cross
10	Hallgarth Medieval Hall And Moat
11	Romano-British Enclosure
12	Romano-British Enclosure in Burton Bushes
13	Square Barrow Cemetery, Moated Site
14	Iron Age Barrow 400M South East Of Station Farm
15	Heavy Anti-Aircraft Gunsite, 350M West Of Butt Farm
16	Royal Observer Corps Underground Monitoring Post

N

GRID NORTH

22

8

21

19

5 - Skipsea Castle

9 - Hallgarth Medieval Hall And Moat

15 - Royal Observer Corps Underground Monitoring Post

North Sea

Scoping Boundary

Scoping Boundary Component

Indicative Permanent Cable Area

Indicative Temporary Works

Listed Buildings (Historic England)

I - Buildings of exceptional interest [3]

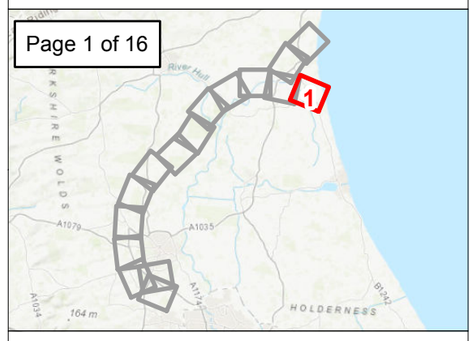
II* - Particularly important building, more than special interest (2)

II - Buildings of special interest [30]

Registered Parks and Gardens (Historic England) [1]

Scheduled Monuments (Historic England) [16]

Conservation Areas (INSPIRE) [5]



Coordinate system: British National Grid

Scale@A3: 1:13000

0 0.1 0.2 0.3 0.4 0.5 Kilometres

0 0.1 0.2 0.3 0.4 0.5 Miles

Designated heritage assets identified within the scoping area
Document no: Annex I
Created by: AA
Checked by: JM
Approved by: NL

ERM

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Sources: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Name: H4SR_Annex_I_CulturalHeritageDesignatedAssets_A3Lan_BNG

Date: 08/10/2018

Author: Alexander.Allan



Sources: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Name: H4SR_Annex_I_CulturalHeritageDesignatedAssets_A3Lan_BNG

Date: 08/10/2018

Author: Alexander.Allan

Hornsea Project

Designated heritage assets identified within the scoping area

Annex I

Key	Listed Building	Grade
1	Church of All Saints	I
2	Church of St Catherine	I
3	Church of St Leonard	I
4	Cross Base East Church of St Andrew	II
5	Woodhouse Farmhouse	II
6	51, Sands Lane	II
7	Church of St James	II
8	Manor House	II
9	Barn at Low Hall	II
10	Old Hall	II
11	1, Arram Road	II
12	Cart-Shed at Rectory Farmhouse	II
13	White House Farm	II
14	Rectory Farmhouse and Wing Walls	II
15	Killingwoldgraves	II
16	White Hall	II
17	Barmston House	II
18	Cattle Shed to Manor Farmhouse	II
19	Church House	II
20	Manor Farmhouse	II
21	The Old Joiners' Shop and Adjoining Barn	II
22	Church of St Andrew	II
23	Garden Walls at Low Hall	II
24	Pantiles	II
25	Manor Farmhouse	II
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2	Moated Site and Two Fishponds
3	Medieval Complex at Barmston Old Hall
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6	Skipsea Castle
7	Beverley Sanctuary Limit Stone, Bishop Burton Cross
8	Beverley Sanctuary Limit Stone, Bentley Cross
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13	Square Barrow Cemetery, Moated Site
14	Iron Age Barrow 400M South East Of Station Farm
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Scoping Boundary

Scoping Boundary Component

Indicative Permanent Cable Area

Indicative Temporary Works

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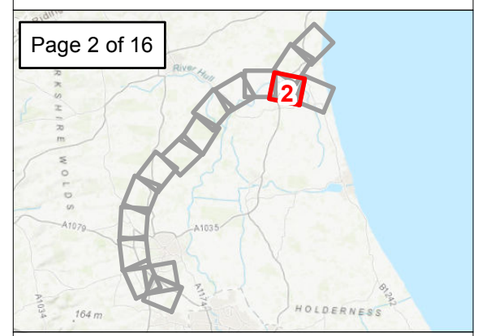
Conservation Areas (INSPIRE) [5]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Coordinate system: British National Grid

Scale@A3: 1:13000

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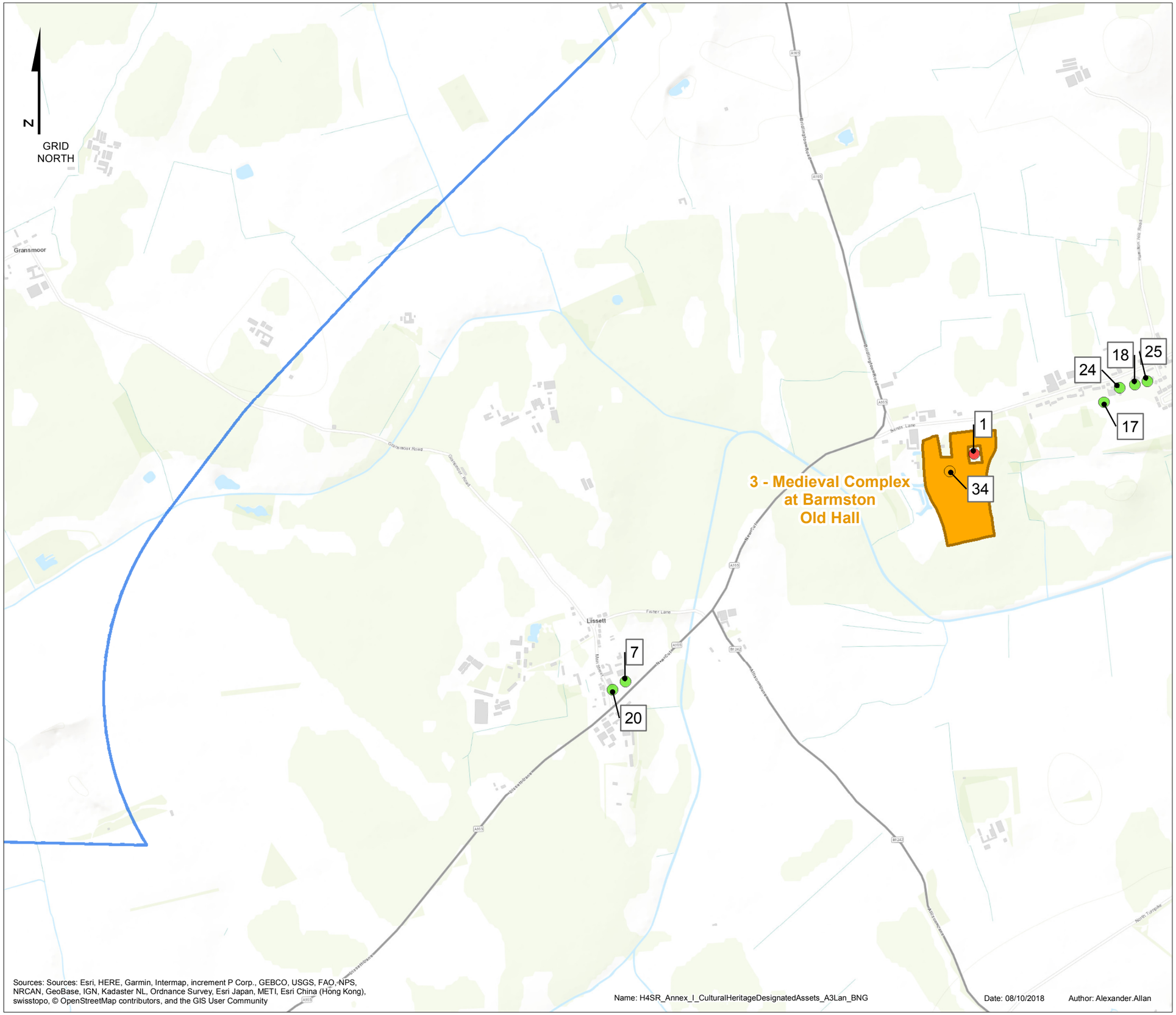

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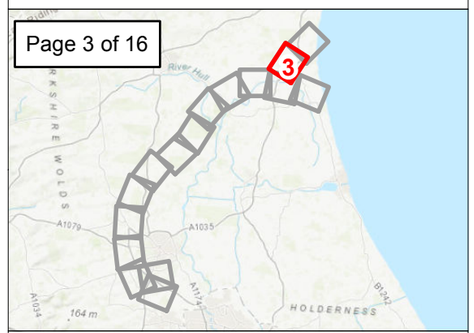

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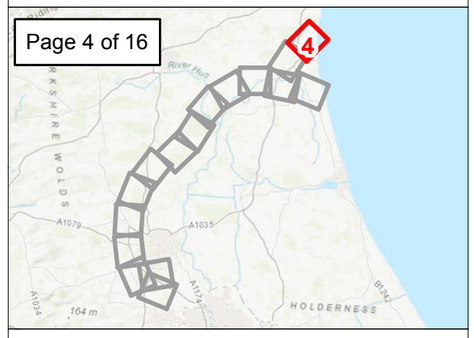

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GRID NORTH

Fraisthorpe

A165

Name: H4SR_Annex_I_CulturalHeritageDesignatedAssets_A3Lan_BNG

Date: 08/10/2018

Author: Alexander.Allan

Sources: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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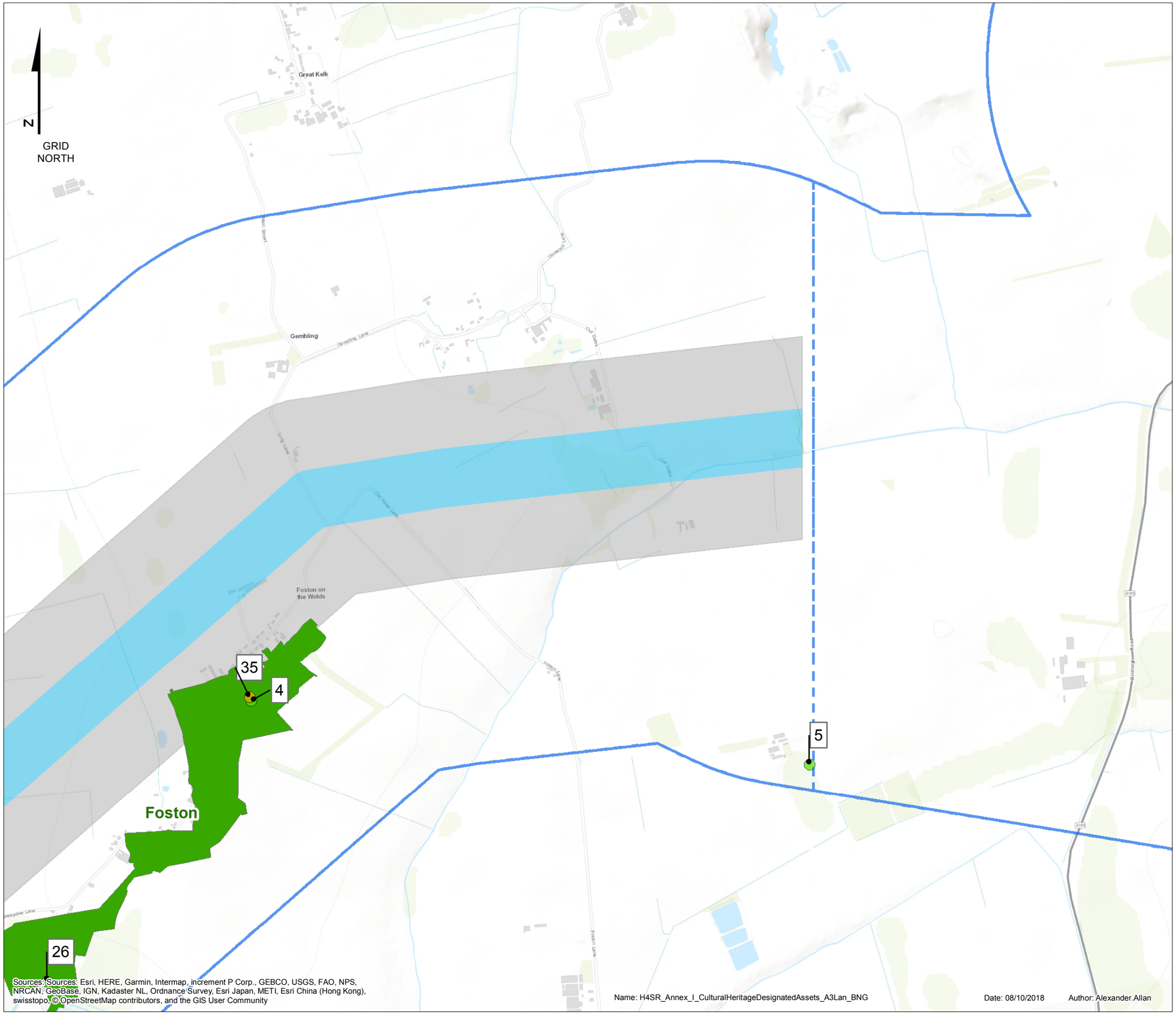

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Scoping Boundary Component

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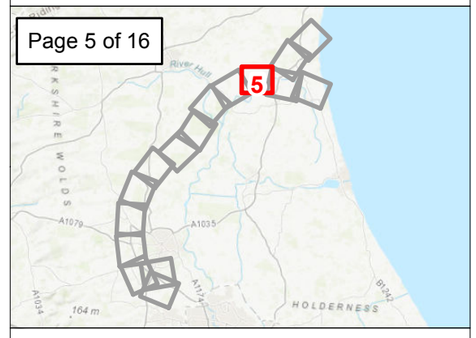

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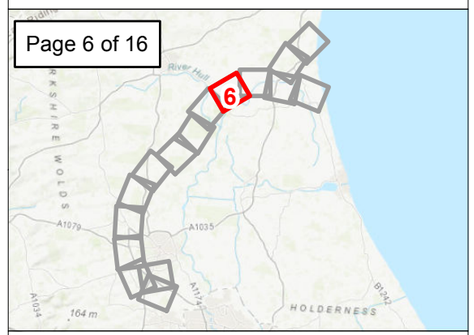

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GRID NORTH

Gembling

Foston on the Wolds

Foston

Brigham

35

4

26

Sources: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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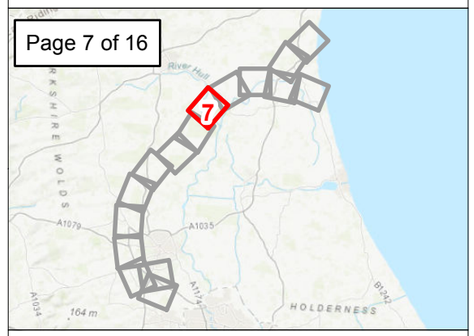

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N

GRID NORTH

1 - Rotsea Medieval Settlement

Rotsea

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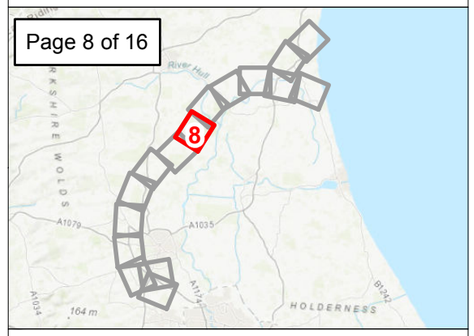

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24	Pantiles	II
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2	Moated Site and Two Fishponds
3	Medieval Complex at Barmston Old Hall
4	Moated Site of Leconfield Castle
5	Moated Site North of Parkhouse Farm
6	Skipsea Castle
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13	Square Barrow Cemetery, Moated Site
14	Iron Age Barrow 400M South East Of Station Farm
15	Heavy Anti-Aircraft Gunsite, 350M West Of Butt Farm
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Scoping Boundary

Scoping Boundary Component

Indicative Permanent Cable Area

Indicative Temporary Works

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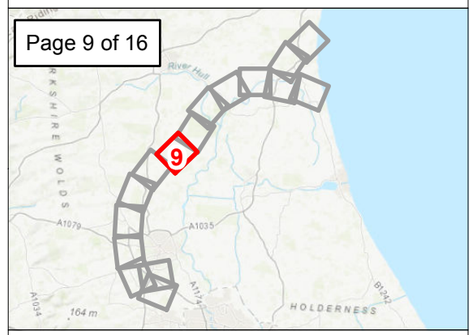

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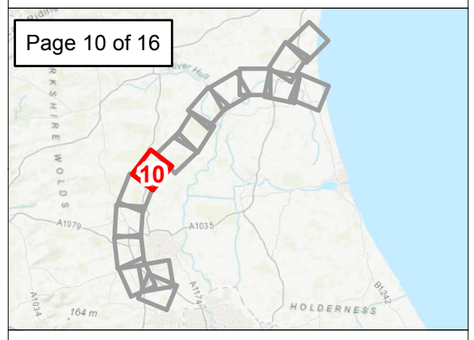

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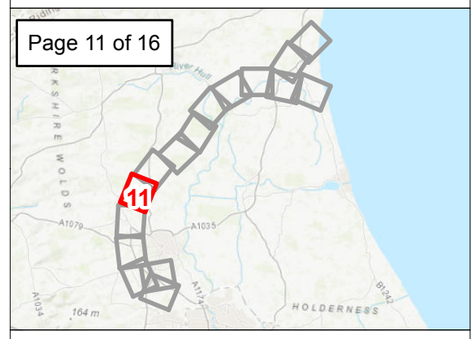

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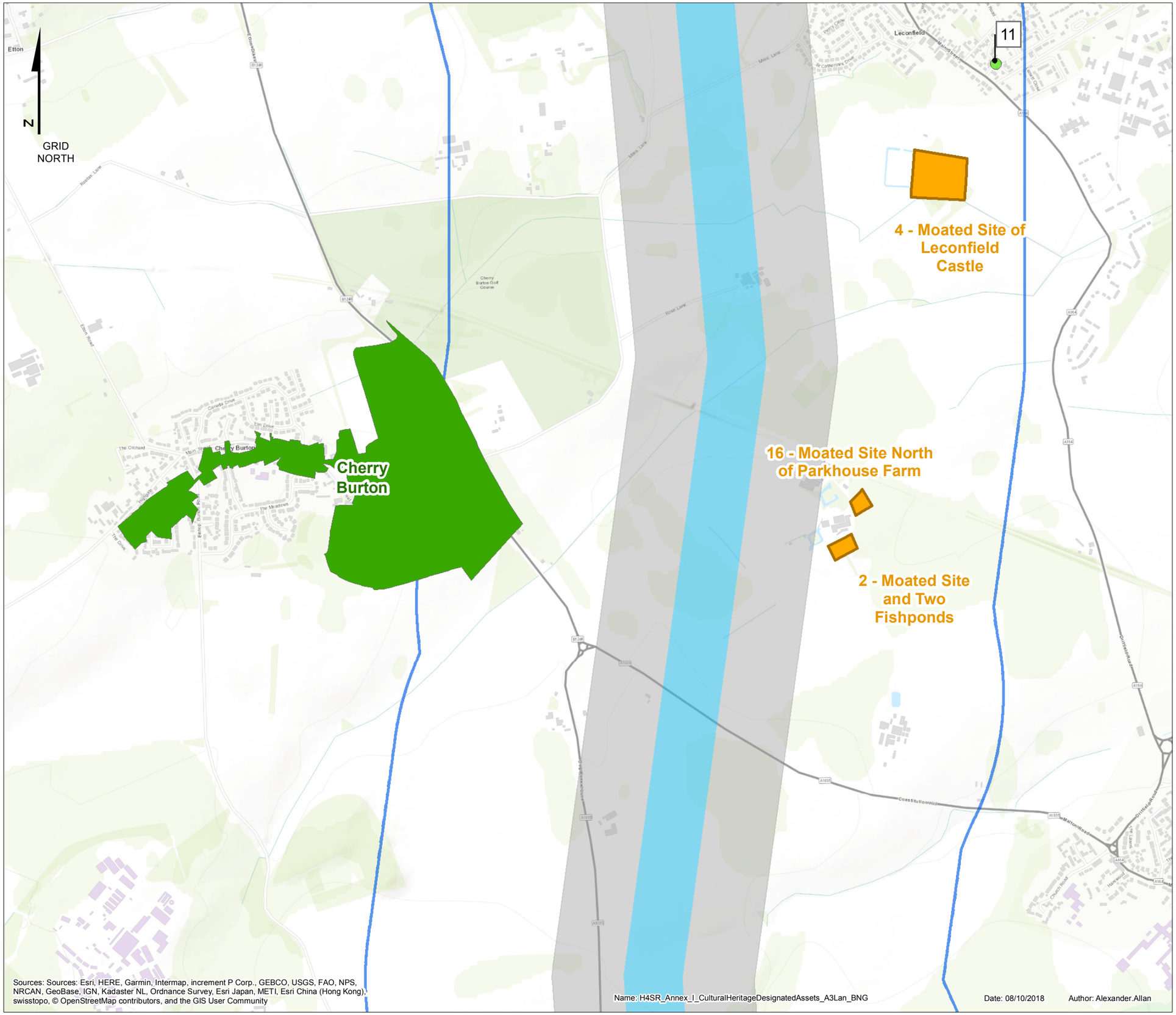

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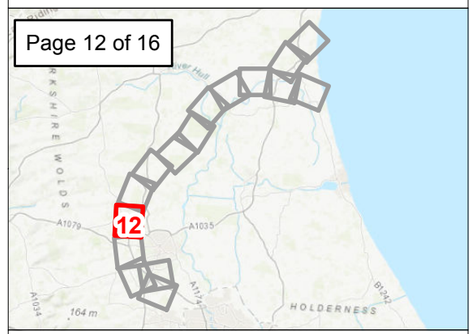

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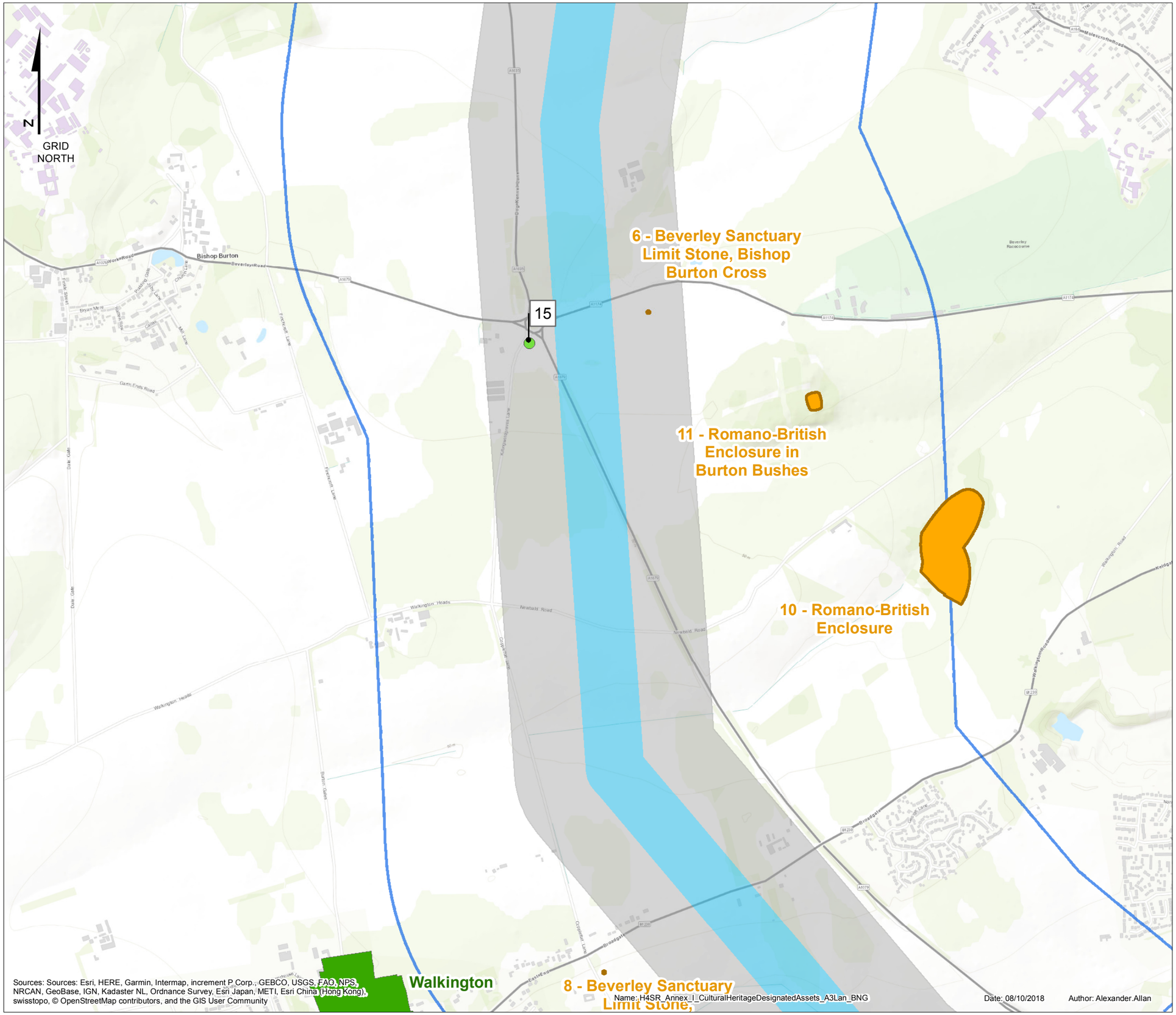

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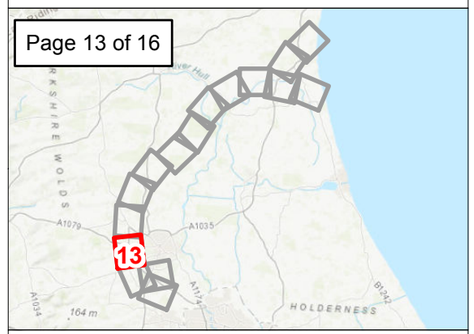

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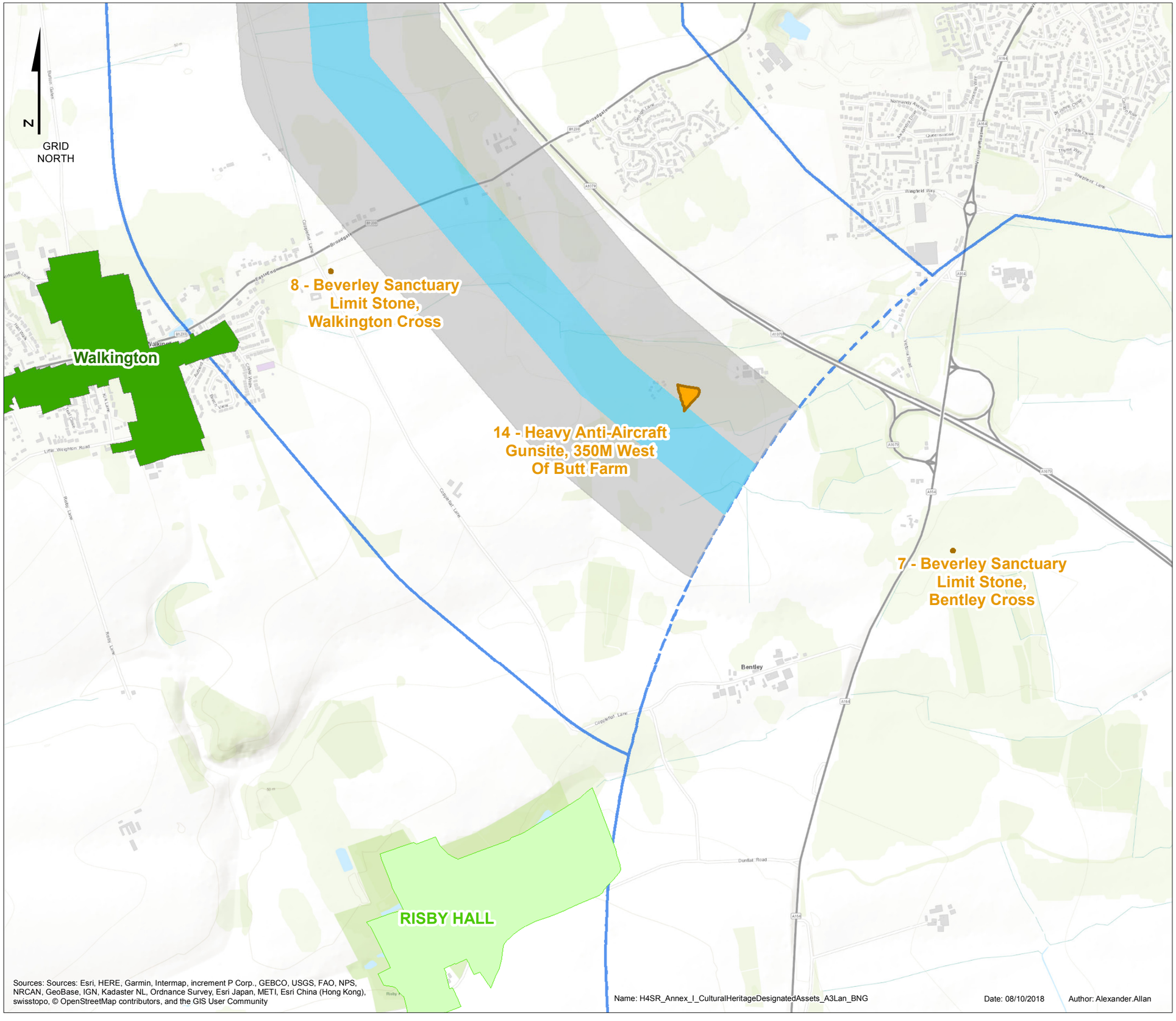

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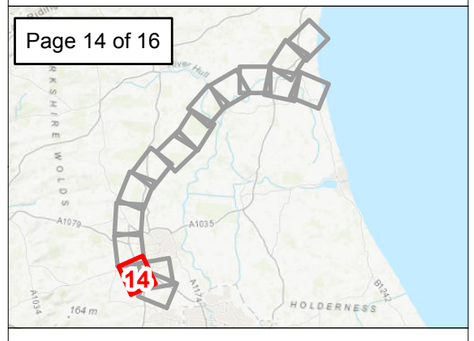

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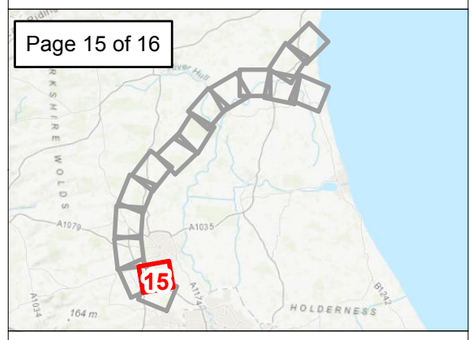

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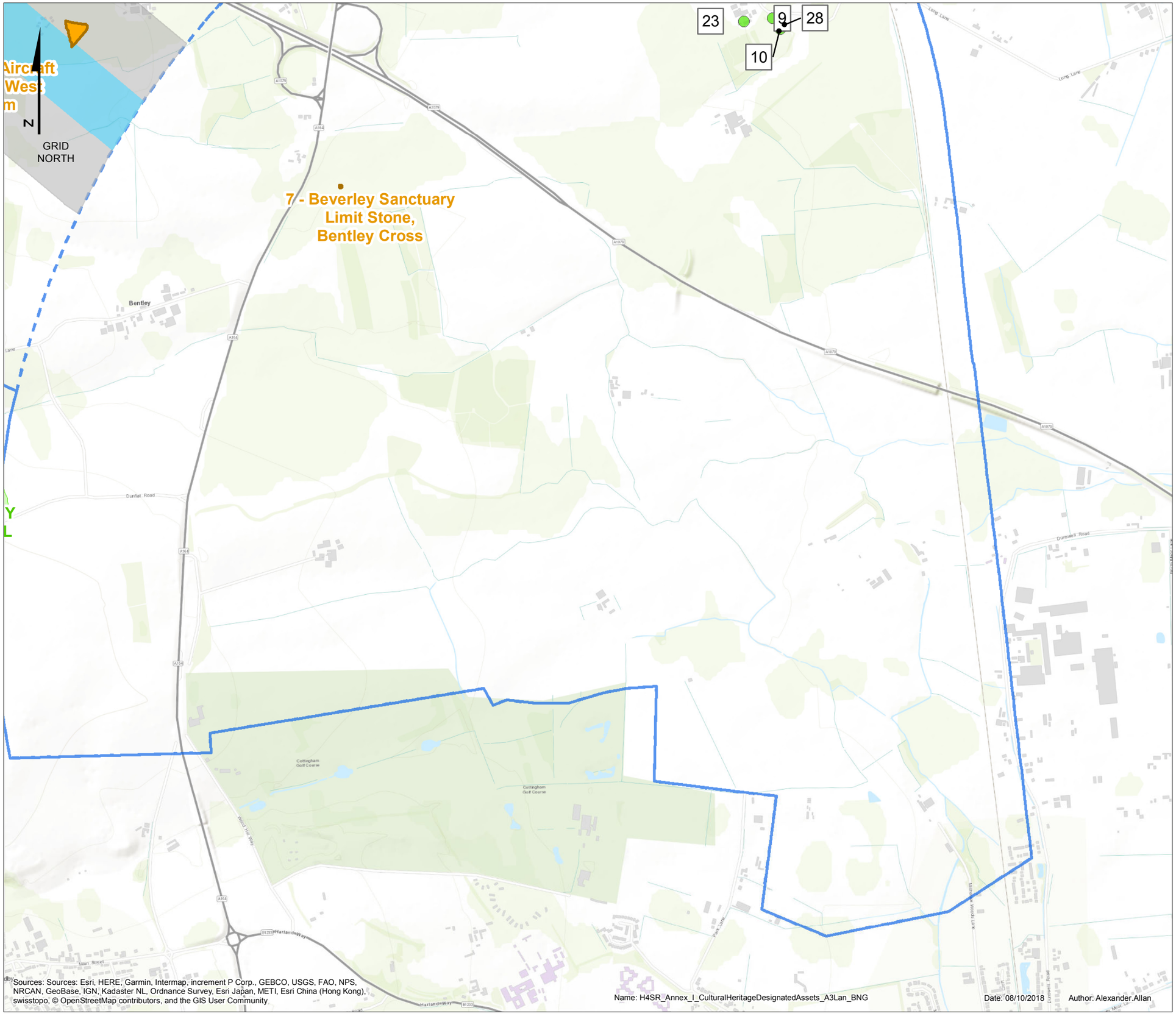
16	White Hall	II
17	Barmston House	II
18	Cattle Shed to Manor Farmhouse	II
19	Church House	II
20	Manor Farmhouse	II
21	The Old Joiners' Shop and Adjoining Barn	II
22	Church of St Andrew	II
23	Garden Walls at Low Hall	II
24	Pantiles	II
25	Manor Farmhouse	II
26	Mill Farmhouse	II
27	Former Lockington Railway Station	II
28	Gate Piers at Low Hall Farm	II
29	WWI Pillbox (Ba10) Auburn Farm	II
30	WWI Pillbox (Ba19), Auburn Farm	II
31	WWI Pillbox (Ba22), Auburn Farm	II
32	WWI Pillbox (Ba30A), Auburn Farm	II
33	WWI Pillbox (Ba30B), Auburn Farm	II
34	Old Hall	II*
35	Church of St Andrew	II*

Key	Scheduled Monument Name
1	Rotsea Medieval Settlement
2	Moated Site and Two Fishponds
3	Medieval Complex at Barmston Old Hall
4	Moated Site of Leconfield Castle
5	Moated Site North of Parkhouse Farm
6	Skipsea Castle
7	Beverley Sanctuary Limit Stone, Bishop Burton Cross
8	Beverley Sanctuary Limit Stone, Bentley Cross
9	Beverley Sanctuary Limit Stone, Walkington Cross
10	Hallgarth Medieval Hall And Moat
11	Romano-British Enclosure
12	Romano-British Enclosure in Burton Bushes
13	Square Barrow Cemetery, Moated Site
14	Iron Age Barrow 400M South East Of Station Farm
15	Heavy Anti-Aircraft Gunsite, 350M West Of Butt Farm
16	Royal Observer Corps Underground Monitoring Post



Scoping Boundary

Scoping Boundary Component

Indicative Permanent Cable Area

Indicative Temporary Works

Listed Buildings (Historic England)

I - Buildings of exceptional interest [3]

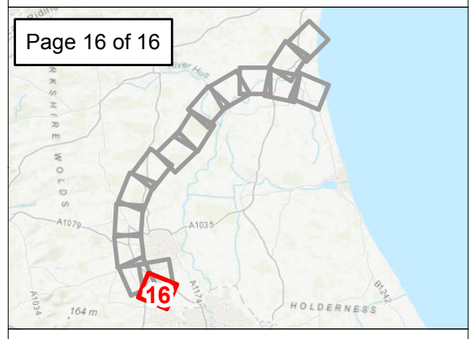
II* - Particularly important building, more than special interest (2)

II - Buildings of special interest [30]

Registered Parks and Gardens (Historic England) [1]

Scheduled Monuments (Historic England) [16]

Conservation Areas (INSPIRE) [5]



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Author: Alexander.Allan

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Annex I

N

GRID NORTH

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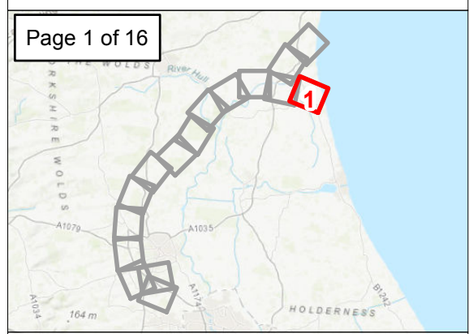
Heritage Asset Locations [731]

Heritage Asset Linear Features [313]

Heritage Asset Areas [20]



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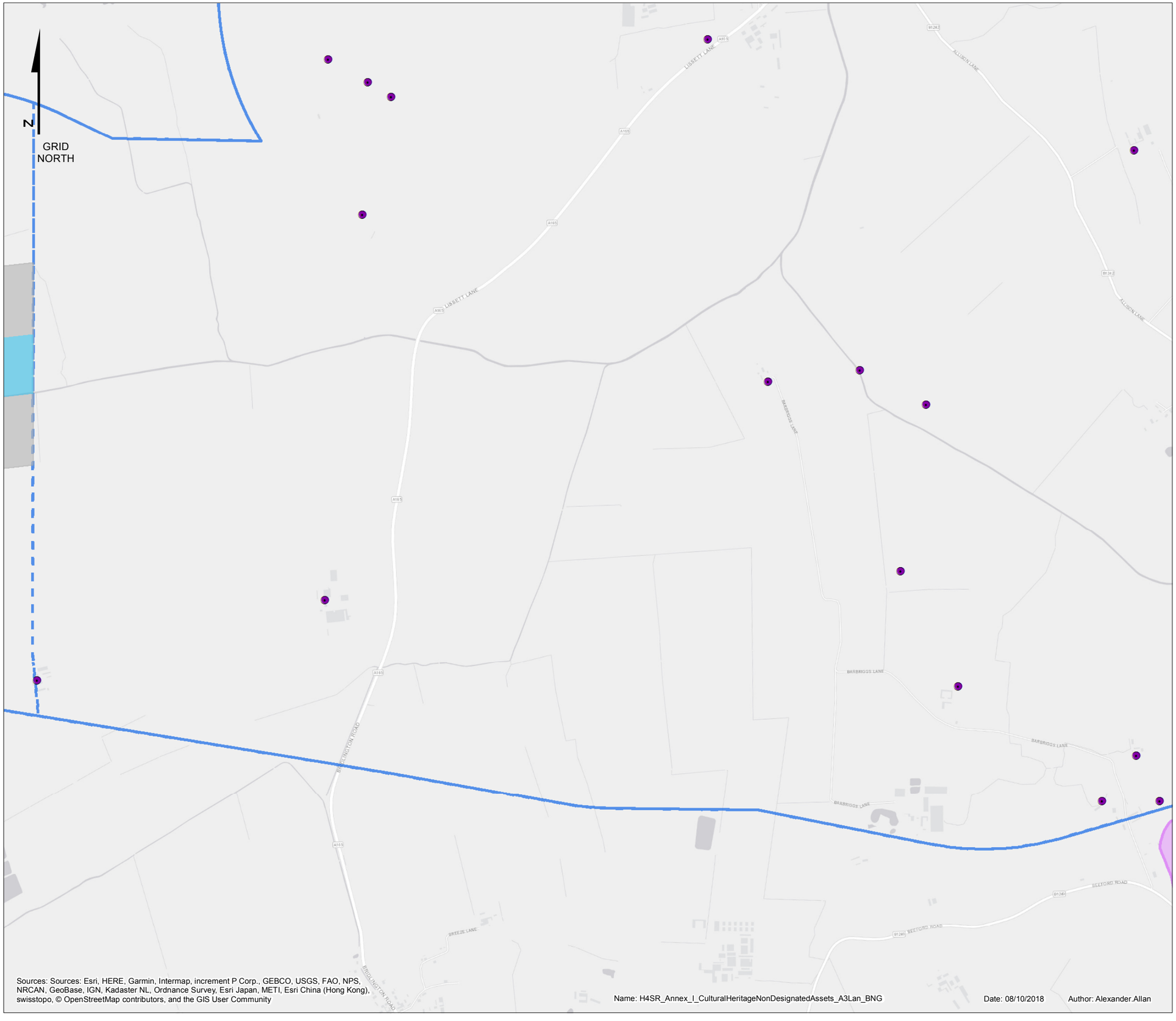

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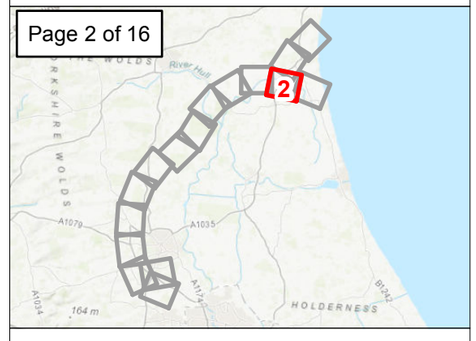

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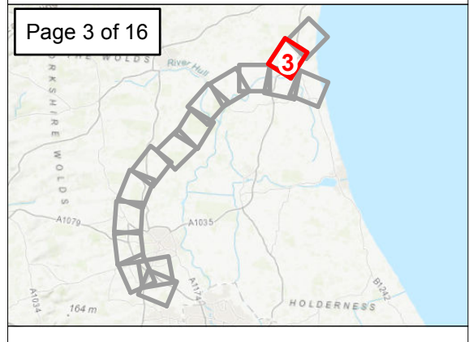

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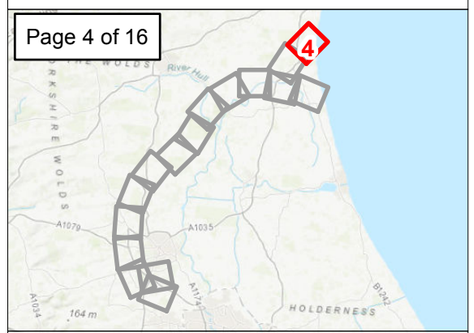

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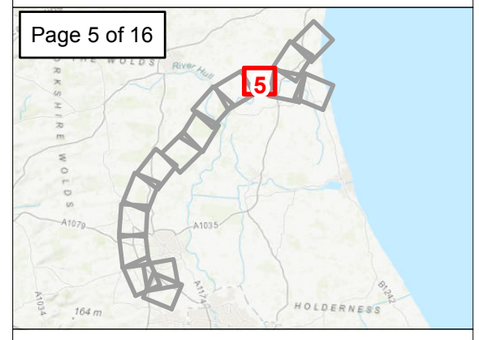

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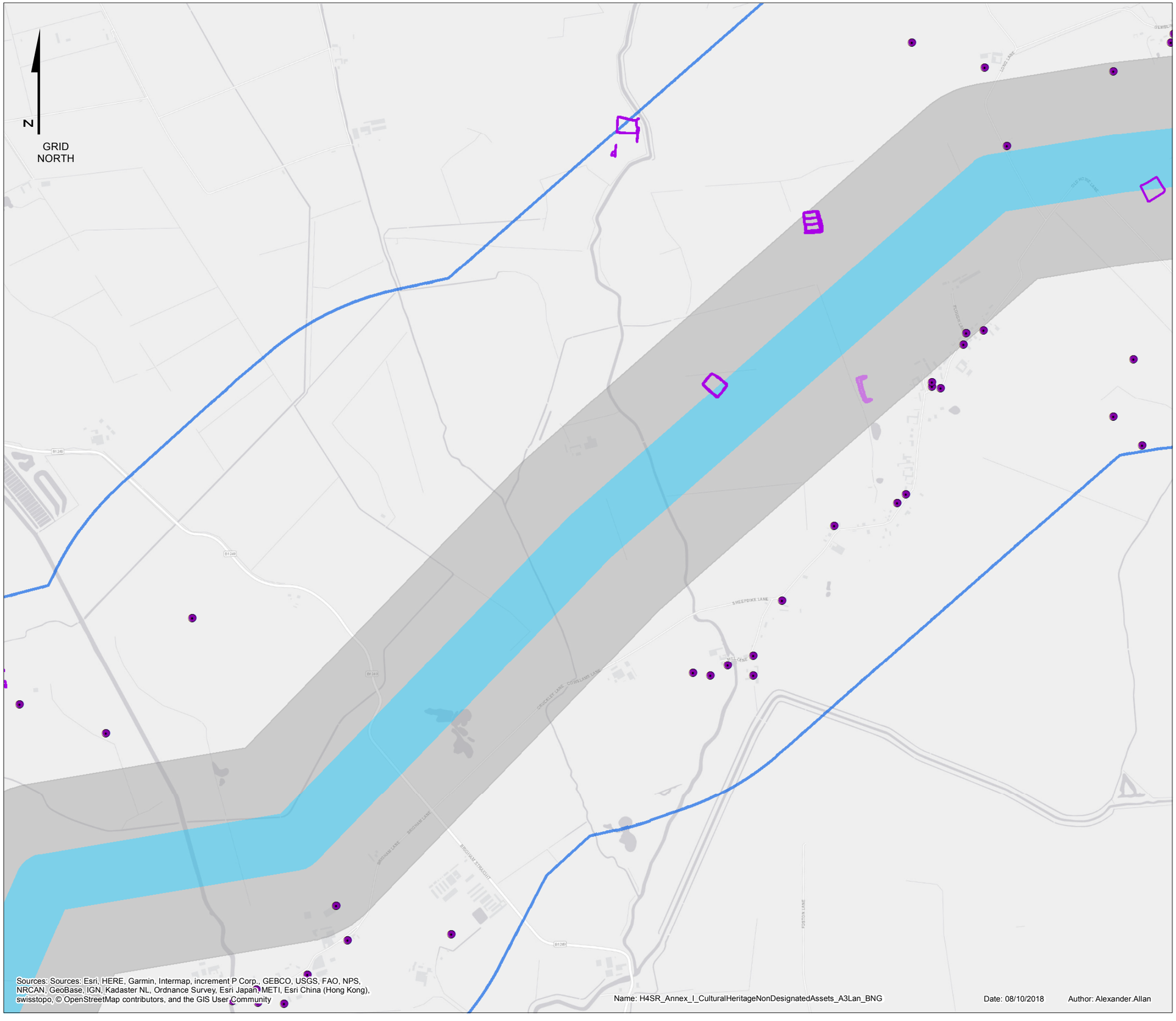

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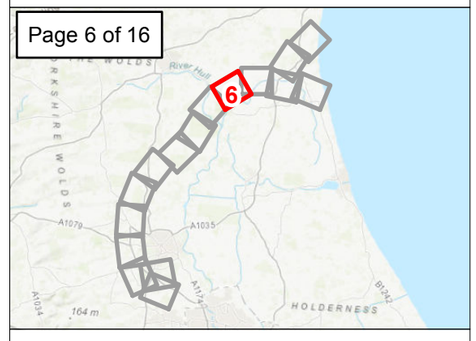

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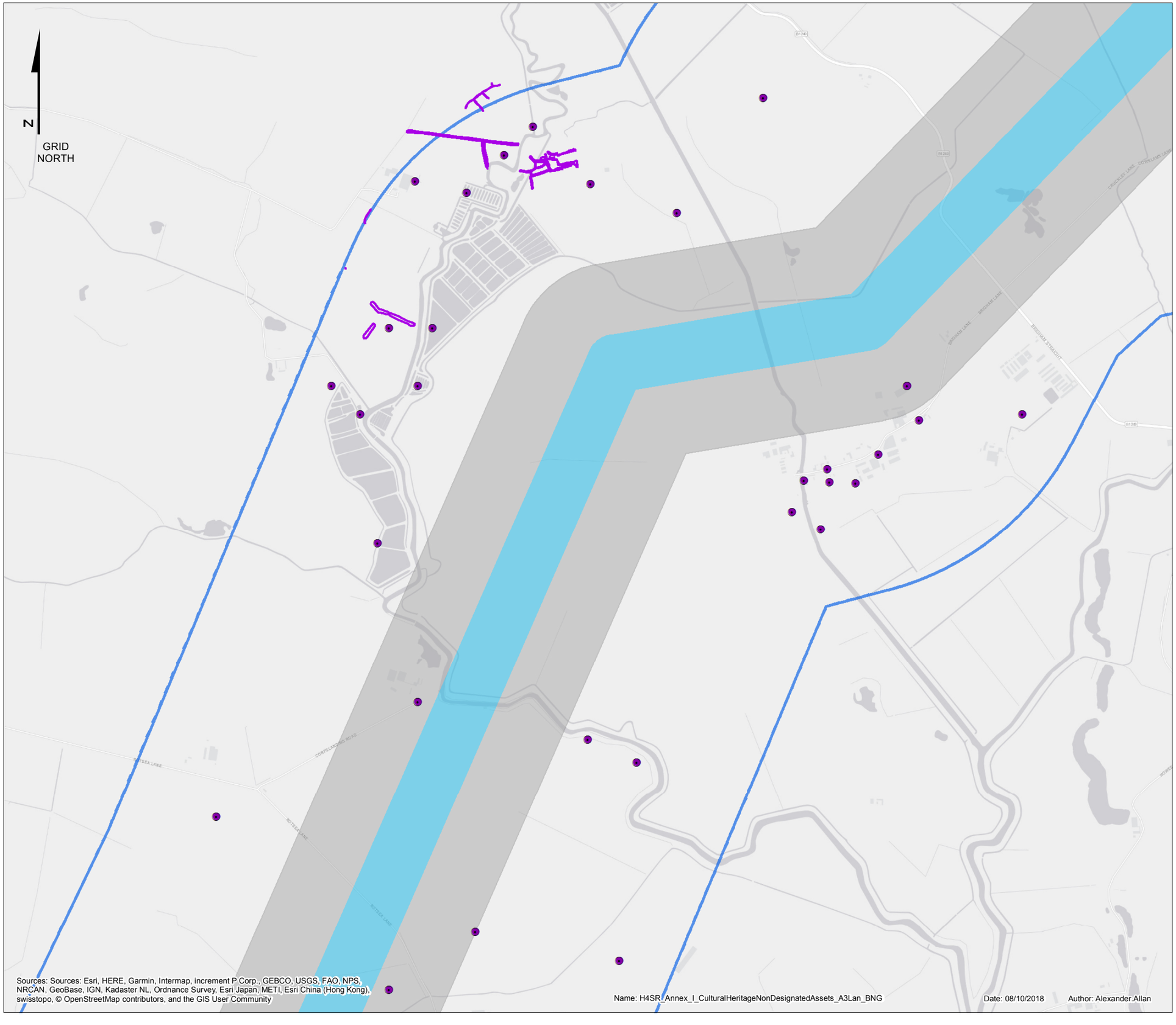

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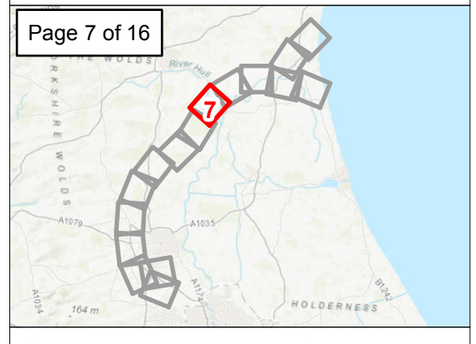

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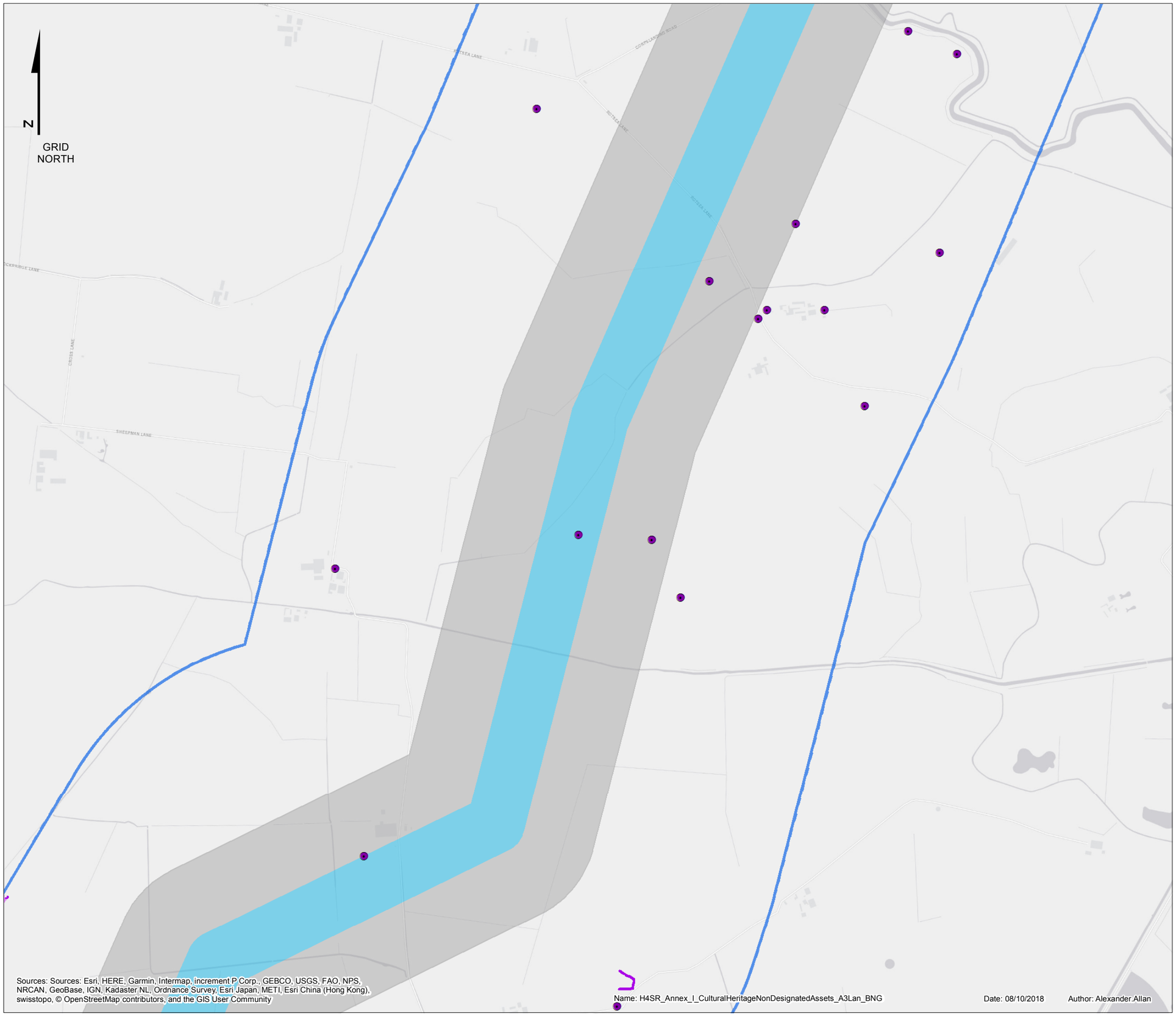

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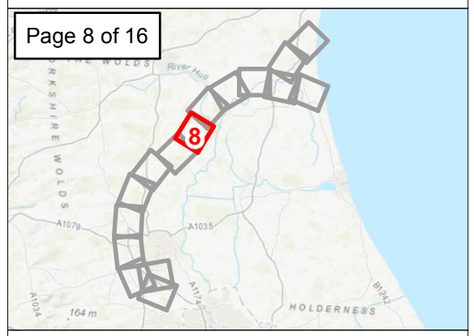

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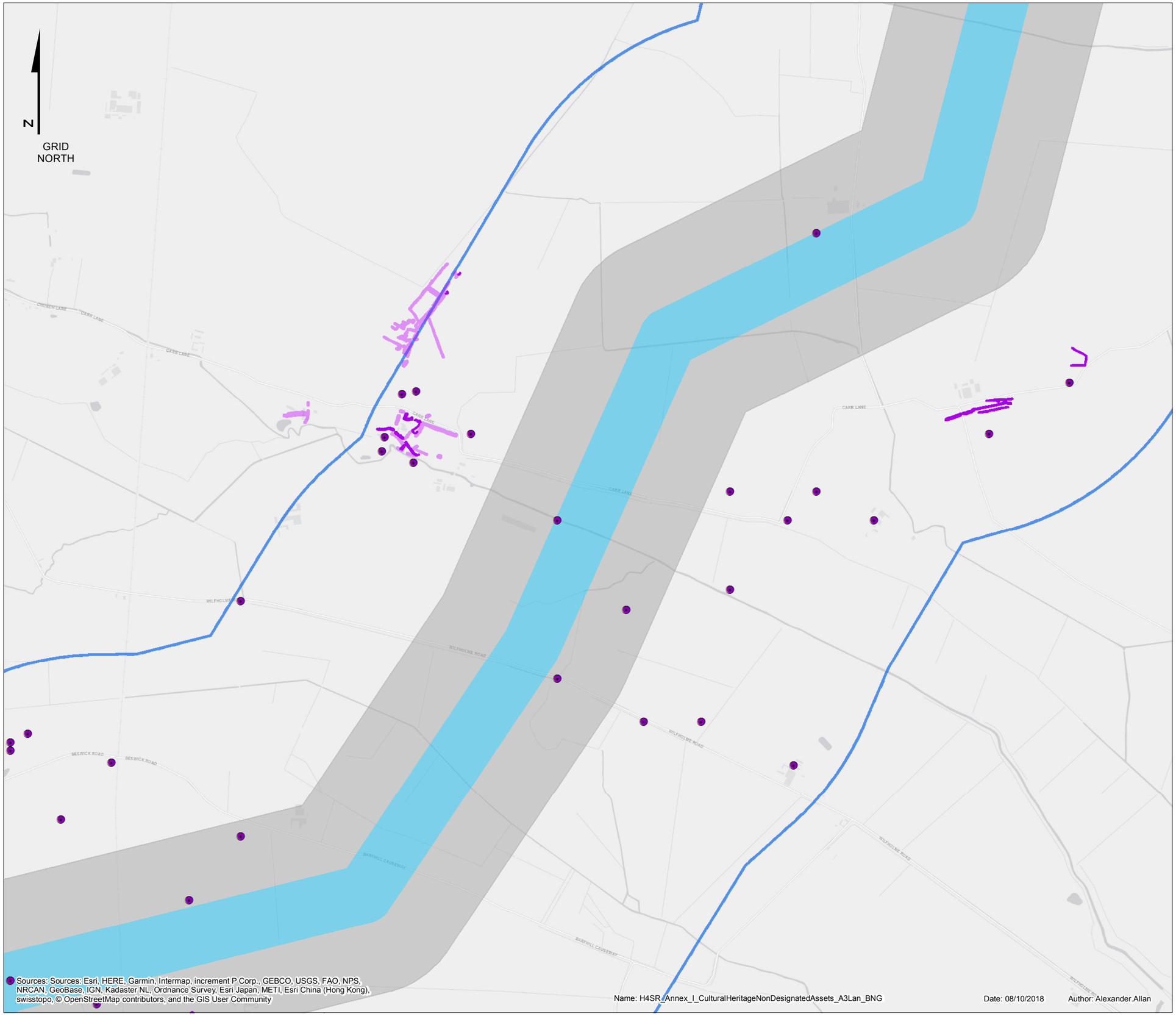

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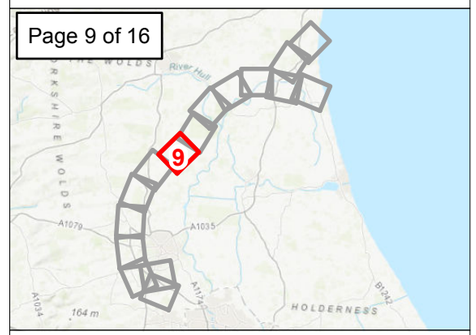

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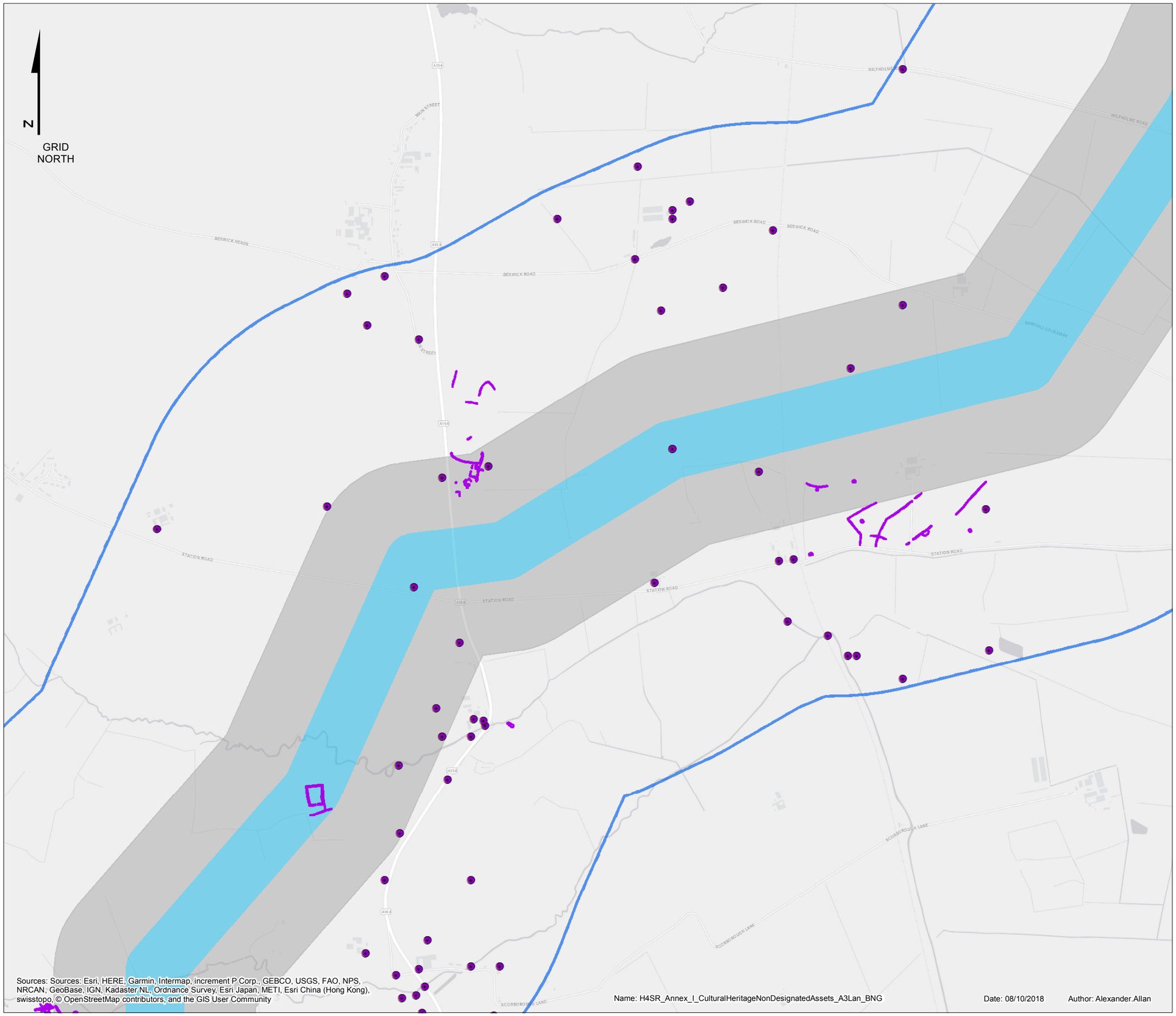

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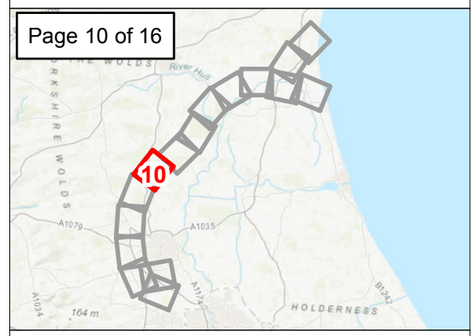

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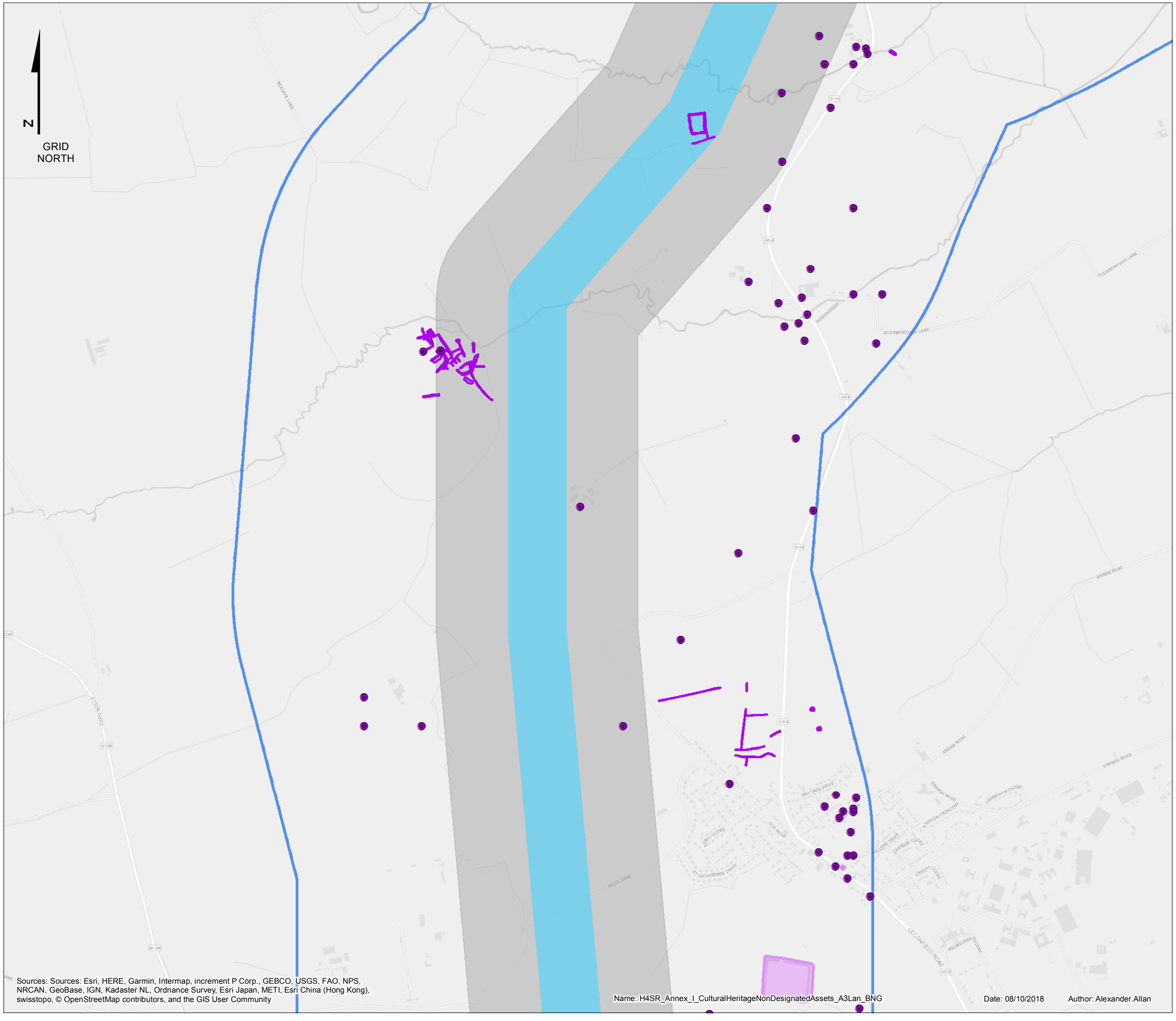

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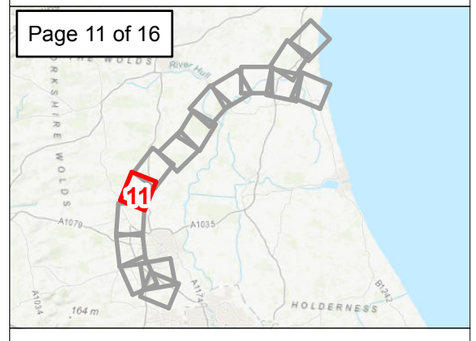

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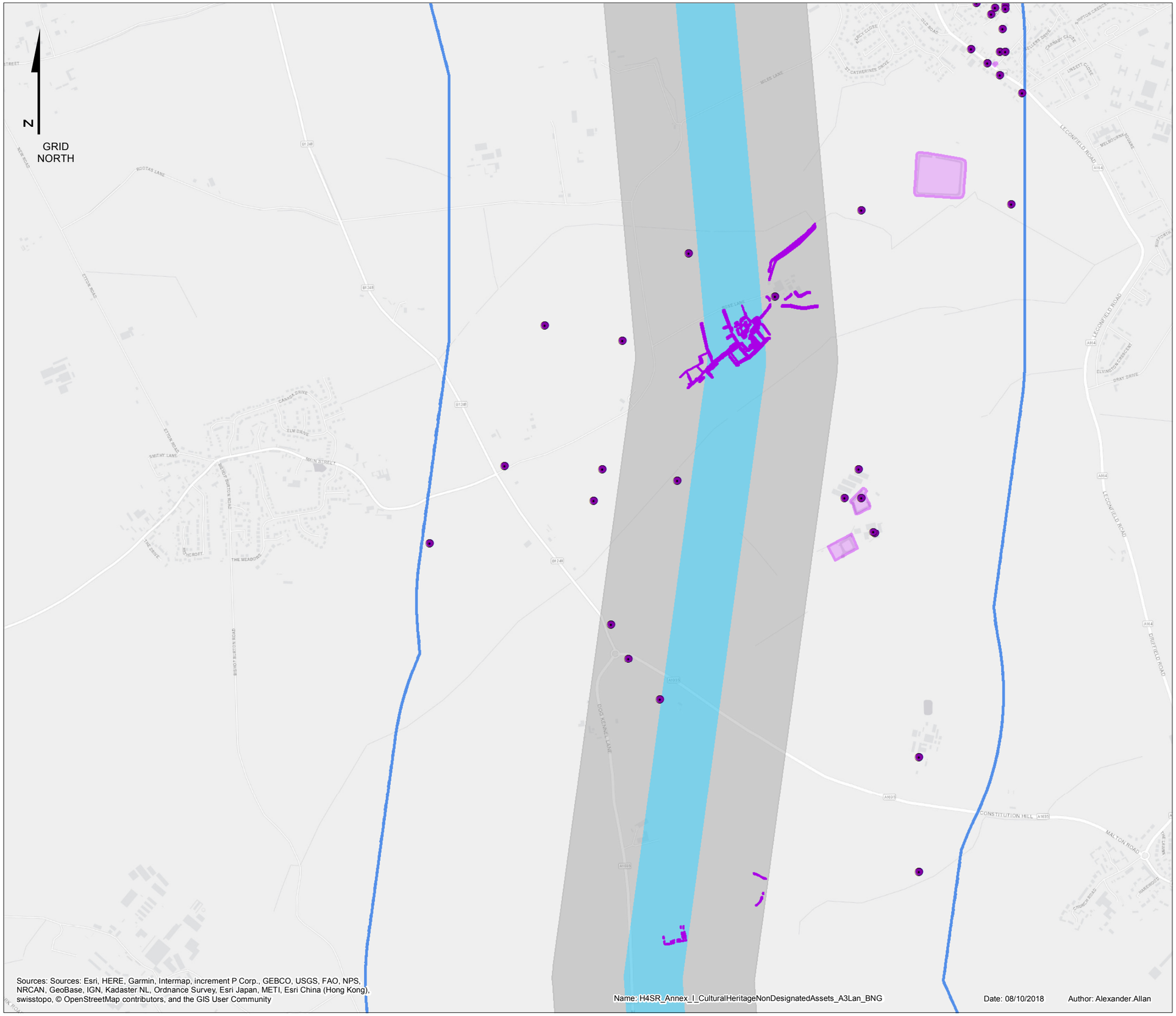

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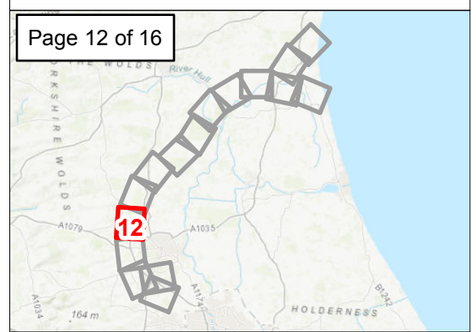

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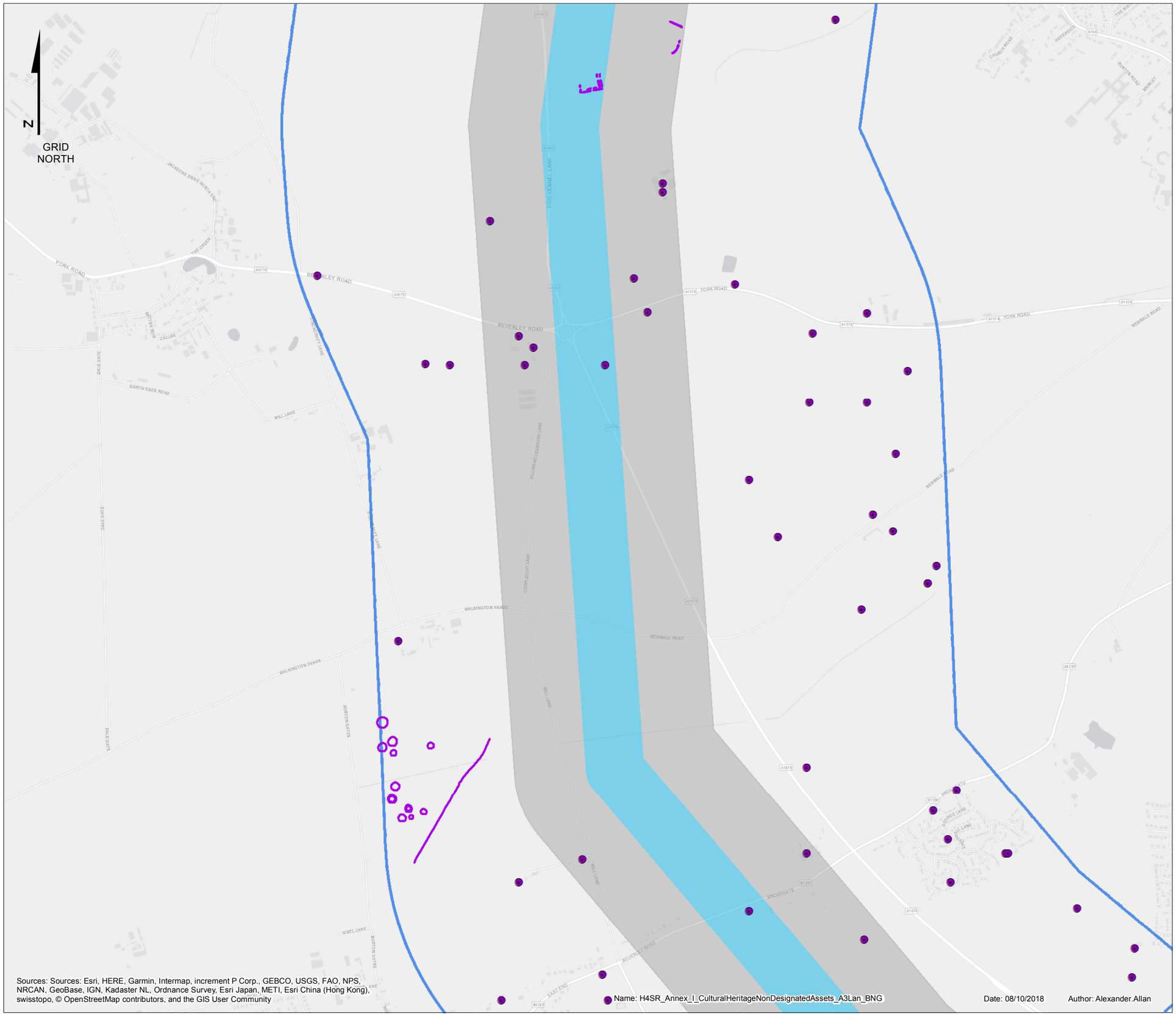

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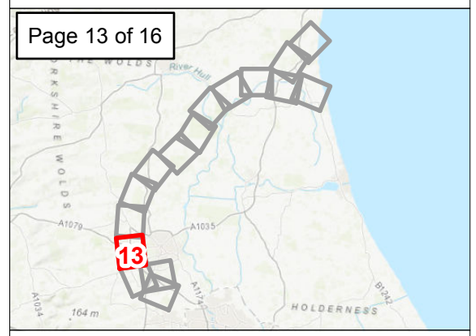

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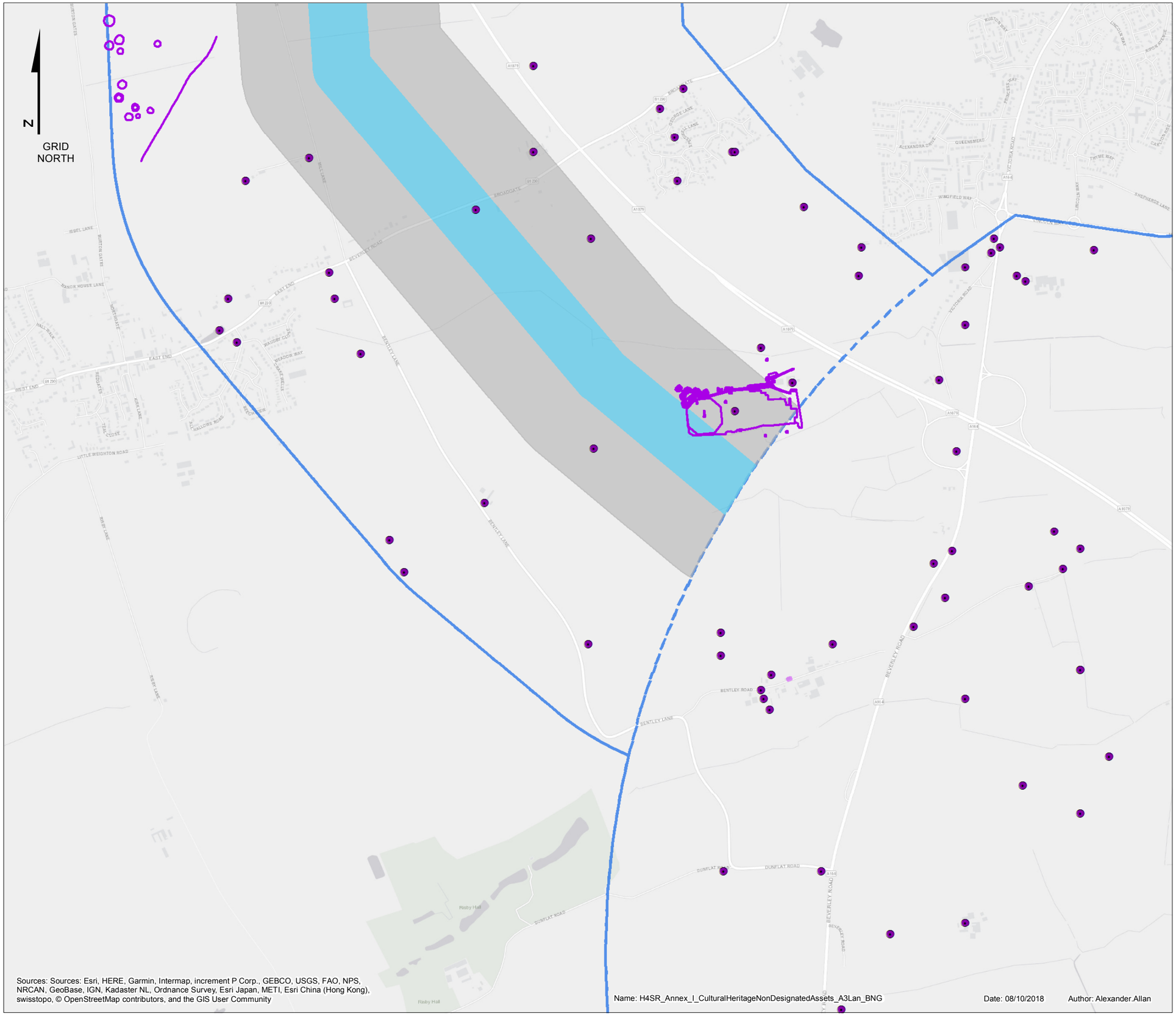

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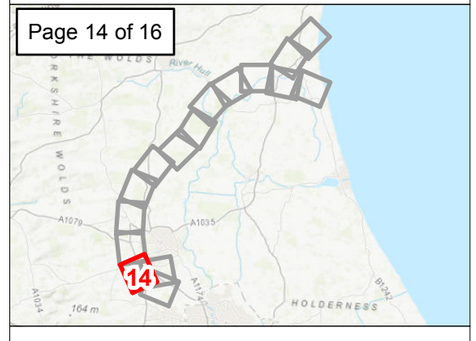

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Non-designated heritage assets identified within the scoping area
Document no: Annex I
Created by: AA
Checked by: JM
Approved by: NL

ERM Ørsted

Sources: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Name: H4SR_Annex_I_CulturalHeritageNonDesignatedAssets_A3Lan_BNG

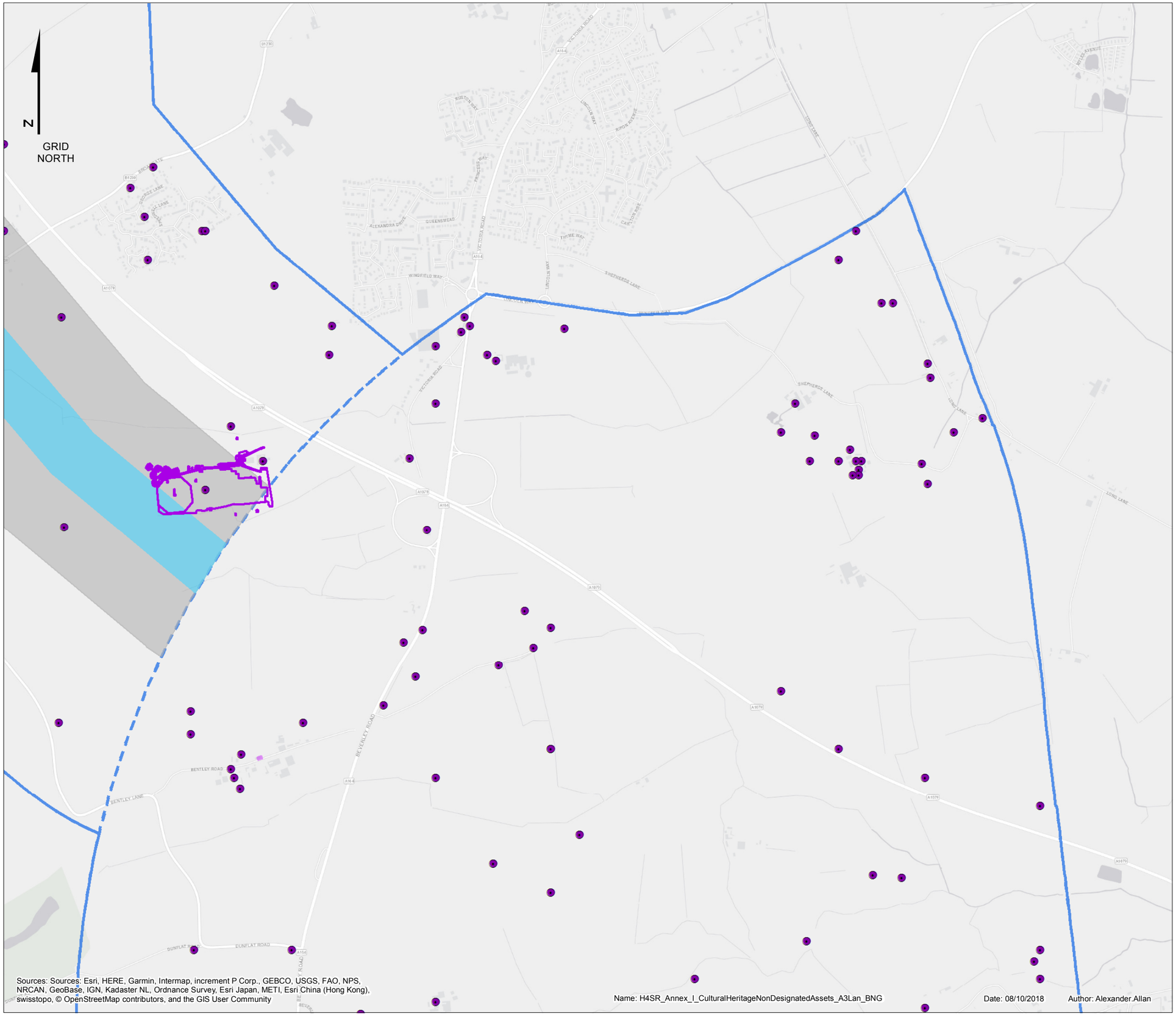
Date: 08/10/2018

Author: Alexander.Allan

Hornsea Four

Non-designated heritage assets identified within the scoping area

Annex I



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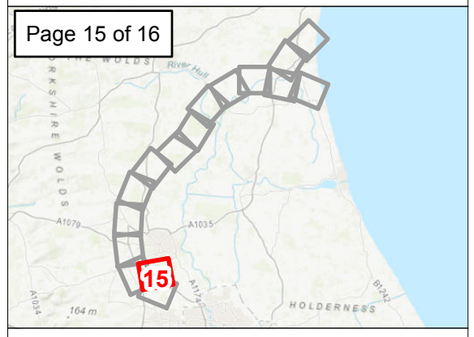
Name: H4SR_Annex_I_CulturalHeritageNonDesignatedAssets_A3Lan_BNG

Date: 08/10/2018

Author: Alexander.Allan

- Scoping Boundary
- Scoping Boundary Component
- Indicative Permanent Cable Area
- Indicative Temporary Works
- Heritage Asset Locations [731]
- Heritage Asset Linear Features [313]
- Heritage Asset Areas [20]



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Non-designated heritage assets identified within the scoping area

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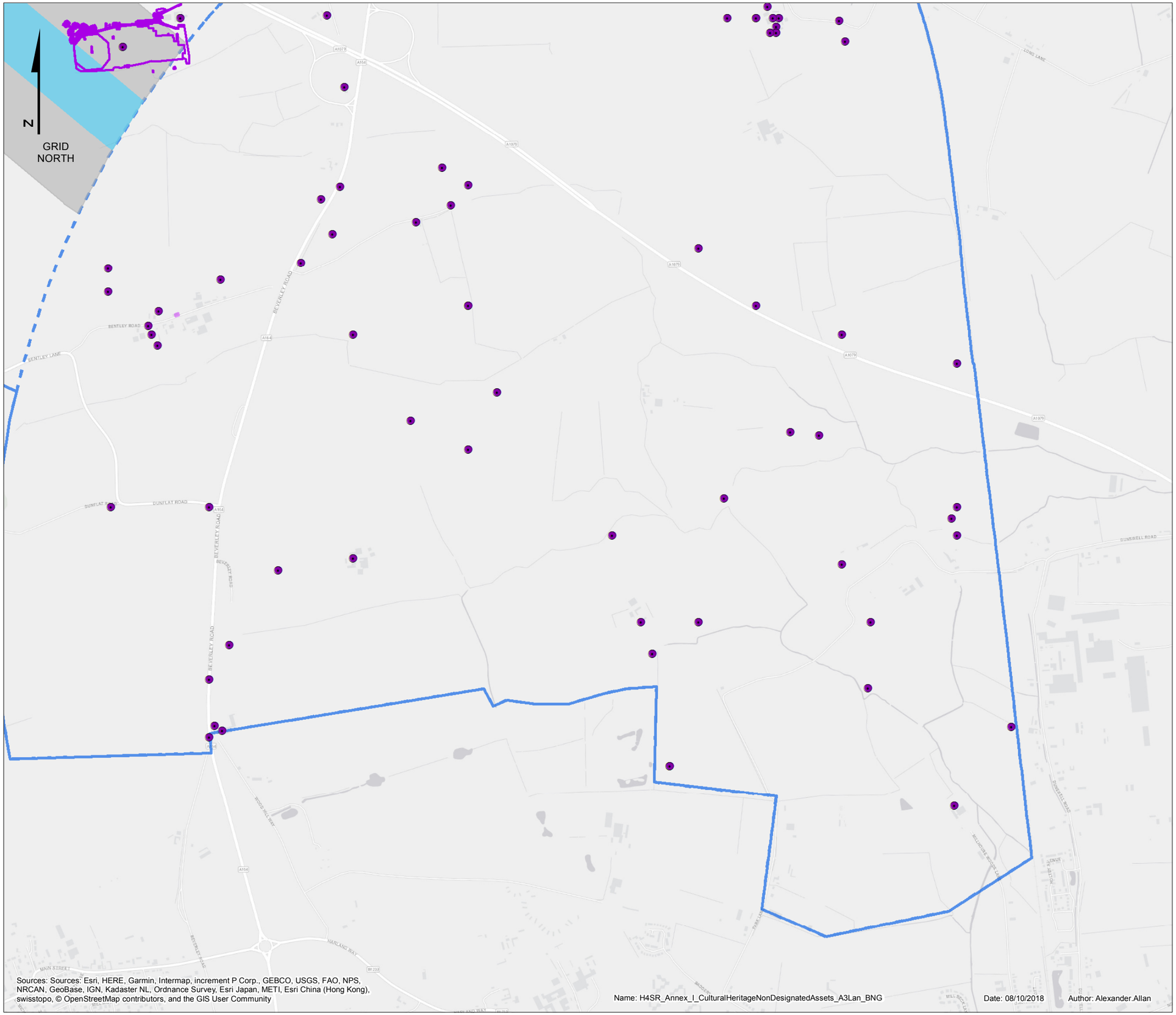

Scoping Boundary

Scoping Boundary Component

Indicative Permanent Cable Area

Indicative Temporary Works

Heritage Asset Locations [731]

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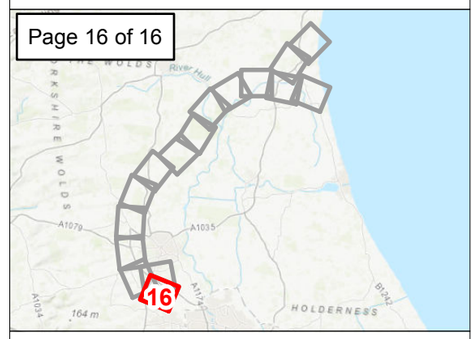

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Date: 08/10/2018

Author: Alexander.Allan

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Environmental Impact Assessment: Scoping Report

Annex J Inter-Related Effects Screening

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1 Inter-related Effects.....3

1 Inter-related Effects

1.1.1.1 Consideration of the inter-relationships between EIA topics that may lead to environmental effects, is required under Schedule 4, of The Infrastructure Planning (EIA) Regulations 2017. For example, the separate impacts of suspended sediment movement and habitat loss may in combination have an effect upon a single receptor, such as benthic ecology.

1.1.1.2 Guidance on inter-related effects is provided within Section 4.13 of PINS Advice Note Nine: Rochdale Envelope (PINS, 2018), which states that *"Inter-relationships consider impacts of the proposals on the same receptor. These occur where a number of separate impacts, (e.g. noise and air quality), affect a single receptor such as fauna"*. The approach to inter-related effects will take into account this Advice Note, along with any other guidance that may prevail at the time of submission.

1.1.1.3 The approach to the assessment of inter-related effects considers receptor-led effects; that is effects that interact spatially and/or temporally resulting in interrelated effects upon a single receptor.

1.1.1.4 The assessment of inter-related effects will be undertaken with specific reference to the potential for such effects to arise in relation to receptor groups. The term 'receptor group' is used to highlight the fact that the proposed approach to inter-relationships assessment will, in the main, not assess every individual receptor assessed at the EIA stage, but rather, potentially sensitive groups of receptors.

1.1.1.5 The broad approach to inter-related effects assessment will follow the below key steps:

- Review of effects for individual EIA topic areas;
- Review of the assessment carried out for each EIA topic area, to identify "receptor groups" requiring assessment;
- Potential inter-related effects on these receptor groups identified via review of the assessment carried out across a range of topics;
- Development of lists for all potential receptor-led effects; and
- Qualitative assessment on how individual effects may combine to create inter-related effects.

1.1.1.6 It is important to note that the inter-relationships assessment will consider only effects produced by Hornsea Four , and not those from other projects (these will be considered within the CEA). Note that for receptors/impacts scoped out of the EIA process based on the findings of the Impacts Register (see Section 5.4.3 and Annex A) and the Scoping Report, no inter-related assessment will be undertaken.

1.1.1.7 **Table 1-1** and **Table 1-2** present an initial screening of inter-related effects that will feed into PEI and then the ES for offshore and onshore respectively. This screening will be updated as scoping continues into PEI and ES so that the consideration of inter-related effects remains proportional.

Table 1-1: Offshore Inter-related Effects

	Marine Processes	Benthic ecology	Fish and Shellfish ecology	Marine Mammals	Offshore Ornithology	Commercial Fisheries	Shipping and Navigation	Aviation, Military and Communication	Marine Archaeology	Seascape and visual resources	Infrastructure and other marine users
Marine Processes		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benthic ecology	Increased SSC and sediment deposition resulting in indirect effects on benthic ecology (construction and decommissioning). Alteration of seabed habitats due to effects on physical processes such as , scour and changes in wave and tidal regimes (operation and maintenance).		Changes in the fish and shellfish community may lead to change in benthic communities (due to changes in predation) (construction, operation and maintenance, and decommissioning).	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fish and Shellfish ecology	Increased SSC and sediment deposition resulting in indirect effects on fish and shellfish ecology (i.e. through avoidance behaviour, physiological effects, effects on eggs and larvae, smothering effects) (construction and decommissioning).	Temporary or long term habitat loss resulting in indirect effects on fish and shellfish ecology (construction, operation and maintenance and decommissioning).		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Marine Mammals	Increased SSC may impair the foraging ability of marine mammals (construction and decommissioning). Changes in the fish and shellfish community may lead to loss of prey resources for marine mammals (construction, operation and maintenance, and decommissioning)	Changes in the benthic community and knock on effect to fish community may lead to loss of prey resources for marine mammals (construction, operation and maintenance, and decommissioning).	Changes in the fish and shellfish community lead to loss of prey resources for marine mammals (construction, operation and maintenance, and decommissioning).		N/A	N/A	Increase in vessel numbers has the potential to have direct effects on marine mammals (construction, operation and maintenance and decommissioning).	N/A	N/A	N/A	N/A
Offshore Ornithology	N/A	Changes in habitat or abundance and distribution of prey ((construction, operation and maintenance and decommissioning).	Changes in habitat or abundance and distribution of prey resulting in indirect effects on ornithological receptors (construction, operation and maintenance and decommissioning).	N/A		N/A	Increased vessel numbers has potential to have direct effects to Offshore Ornithology (construction, operation and maintenance and decommissioning).	N/A	N/A	N/A	N/A
Commercial fisheries	N/A	N/A	Displacement or disruption of commercially important fish and shellfish	N/A	N/A		N/A	N/A	N/A	N/A	N/A

	Marine Processes	Benthic ecology	Fish and Shellfish ecology	Marine Mammals	Offshore Ornithology	Commercial Fisheries	Shipping and Navigation	Aviation, Military and Communication	Marine Archaeology	Seascape and visual resources	Infrastructure and other marine users
			resources and effect son commercial fisheries targeting those resources (construction and decommissioning)								
Shipping and navigation	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Aviation, Military and communicati on	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A
Marine Archaeology	Seabed preparation activities for foundation installation and sand wave clearance causing sediment deposition on the seabed resulting in a potential effect on a variety of heritage assets (construction).	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A
Seascape and visual resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Visual impacts on the setting of cultural heritage assets (operation and maintenance)		N/A
Infrastructure and other users	Potential for increased suspended sediment concentrations and deposition, which could cause a change in aggregate resource in aggregate extraction areas (construction and decommissioning)	N/A	N/A	N/A	N/A	N/A	N/A	Restriction on access to infrastructure by both helicopter and vessel (operation and maintenance).	N/A	N/A	

Table 1-2: Onshore Inter-related Effects

	Geology and ground conditions	Hydrology and flood risk	Ecology and nature conservation	Landscape and visual	Historic environment	Land use and agriculture	Traffic and transport (and community health and safety)	Noise and vibration (and human health)	Air quality (and human health)	Socio-economic characteristics
Geology and ground conditions		Mobilisation of soil contaminants to surface water run-off	Physical and chemical degradation of soils	Erosion impacts at the landfall	Historical assets can be affected by changes in ground conditions (e.g. subsidence, erosion)	Physical and chemical degradation of agricultural soils	N/A	N/A	Mobilisation of potentially contaminated dust	N/A
Hydrology and flood risk	N/A		N/A	N/A	N/A	Flood risk changes for neighbouring land uses	N/A	N/A	N/A	N/A
Ecology and nature conservation	N/A	N/A		Loss of ecological features (trees, hedgerows) can affect landscape	Loss of ecological features (especially hedgerows) can directly affect a historical asset and affect the setting of others	N/A	N/A	N/A	N/A	N/A
Landscape and visual	N/A	N/A	Introduction of new habitat elements in landscaping		Changes in setting of historical assets	Negative effects on tourism and visitor perception	N/A	N/A	N/A	Effects on tourism leading to negative economic effects
Historic environment	N/A	N/A	N/A	N/A		Loss of historic assets or changes to setting could affect tourism	N/A	N/A	N/A	Effects on tourism leading to negative economic effects
Land use and agriculture		Change in land use at the substation sites could affect run-off characteristics	Change in land use at the substation site could affect habitats	Change in land use at the substation site could affect landscape	Change in land use at the substation site could affect the setting of historical assets		N/A	N/A	N/A	Disruption of land uses and tourism leading to negative economic effects
Traffic and transport (and community health and safety)	N/A	N/A	N/A	N/A	N/A	Traffic disruption of tourism activity		Traffic can have noise impacts at roadside receptors	Traffic can affect air quality for roadside receptors	Effects on tourism leading to negative economic effects
Noise and vibration (and human health)	N/A	N/A	Noise can affect some ecological receptors	N/A	N/A	Construction noise disruption of other land use (e.g. tourism)	N/A		N/A	Effects on tourism leading to negative economic effects
Air quality (and human health)	N/A	N/A	Emissions can affect ecological receptors particularly nitrogen sensitive plants	N/A	N/A	N/A	N/A	N/A		N/A
Socio-economic characteristics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

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Environmental Impact Assessment: Scoping Report

Annex K Transboundary Impacts Screening

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Acronyms and Abbreviations

Term	Definition
DCO	Development Consent Order
ECC	Export Cable Corridor
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EU	European Union
HRA	Habitats Regulations Assessment
HSC	Historic Seascape Characteristic
IMO	International Maritime Organization
LAT	Lowest Astronomical Tide
MHWS	Mean High Water Springs
NM	Nautical Mile
PINS	Planning Inspectorate
REWS	Radar Early Warning System

1 Introduction

1.1.1.1 Annex J identifies the transboundary receptors of relevance to Hornsea Four and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore and onshore components of Hornsea Four on transboundary receptors.

1.2 Legislative Context

1.2.1.1 The need to consider transboundary impacts has been embodied by The United Nations Economic Commission for Europe Convention on Environmental Impact Assessment in a Transboundary Context, adopted in 1991 in the Finnish city of Espoo and commonly referred to as the 'Espoo Convention'. The Convention requires that assessments are extended across borders between Parties of the Convention when a planned activity may cause significant adverse transboundary impacts.

1.2.1.2 The Espoo Convention has been implemented by the European Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, which was amended by Directive 97/11/EC, Directive 2003/35/EC and Directive 2009/31/EC.

1.2.1.3 With regards to NSIPs, the EIA Directive is transposed into UK law by the 2017 EIA Regulations. Regulation 32 of the 2017 EIA Regulations requires that where the Secretary of State is of a view that an EIA application will have significant effects on the environment of another European Economic Area (EEA) State, or the Secretary of State receives a request for involvement from another EEA State, it must undertake a prescribed process of consultation and notification.

1.2.1.4 Planning Inspectorate (PINS) Advice Note 12: Transboundary Impacts (version 5 PINS, March 2018) sets out the procedures for consultation in association with an application for a Development Consent Order (DCO), where such development may have significant transboundary impacts. The note sets out the roles of PINS, other EEA States and developers. In respect of the latter, developers have no formal role under the Regulation 32 process, as the duties prescribed by Regulation 32 in notifying and consulting with other EEA States on potential transboundary impacts are the responsibility of the Secretary of State. However, developers are advised to:

1.2.1.5 Consider, when preparing documents for consultation and application that;

- PINS may notify the relevant EEA State of their particular project;
- Carry out preparatory work to complete a transboundary screening matrix to assist the Secretary of State in determining the potential for likely significant effects on the environment in other EEA States; and
- To submit the transboundary screening matrix along with the scoping request, if a scoping opinion is sought by the developer.

1.2.1.6 This transboundary screening annex is provided in response to PINS Advice Note 12 and the bullet points noted above. It provides information about Hornsea Four which will be the subject of the DCO application and sets out information relating to the potential effects of the scheme on the interests of the other member states in the vicinity, in order to assist PINS in forming a view on the likelihood of significant transboundary effects arising from Hornsea Four.

1.3 Study Area

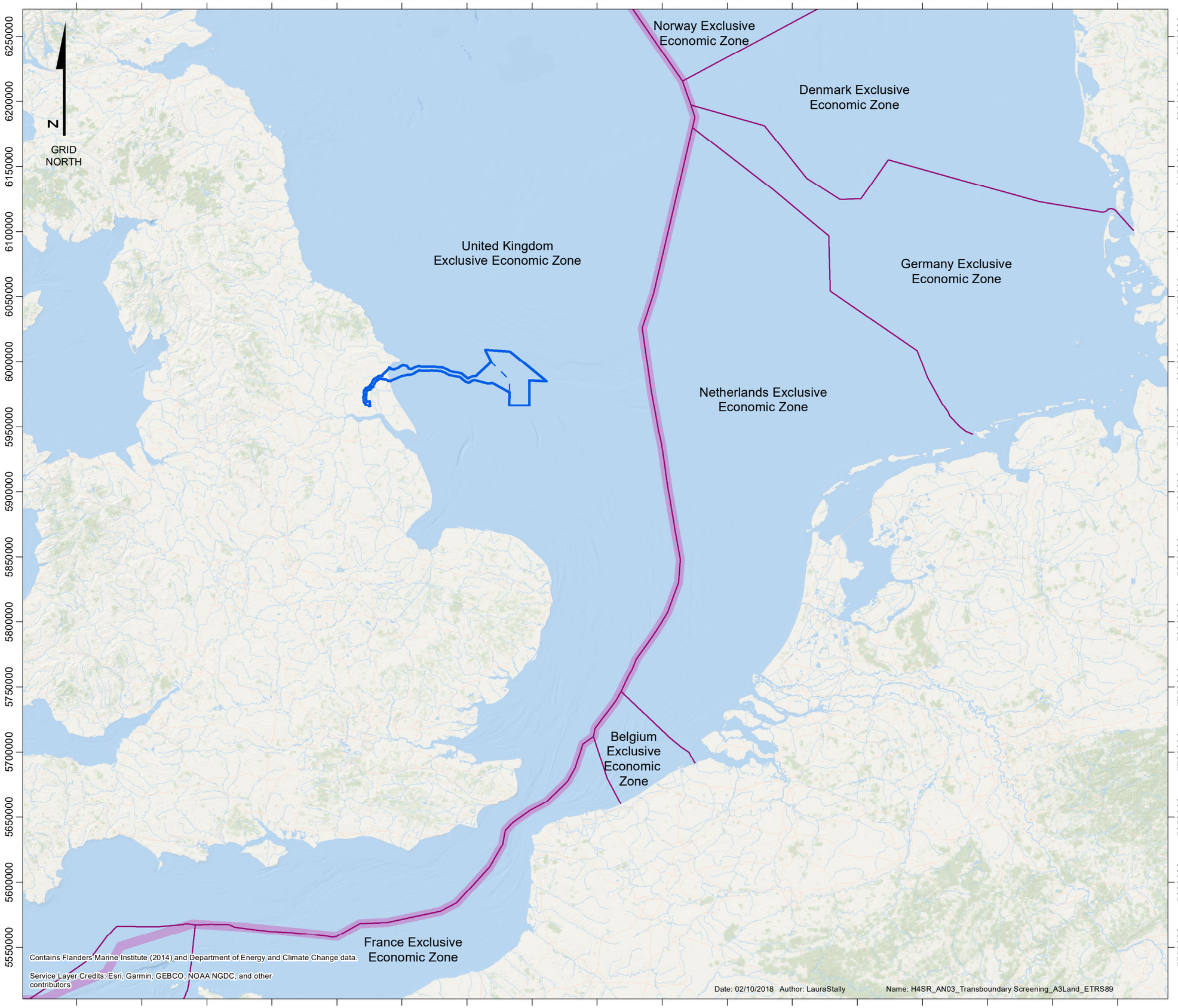
1.3.1.1 The Hornsea Four array area is located outside the 12-nautical mile (NM) limit in UK Exclusive Economic Zone (EEZ) waters. The distance of Hornsea Four from the boundary of the EEZ or 'median' of other EEA States considered is presented in Table 1 and Figure 1.

Table 1 - Summary of approximate distance to nearest EEZ (median line) of other EEA State

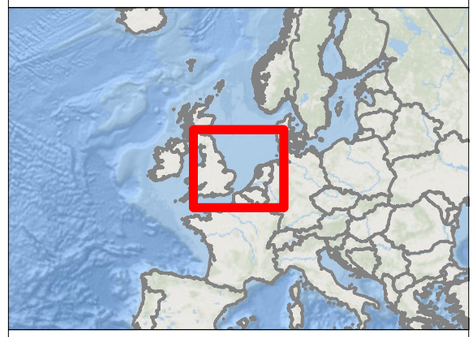
EEZ	Distance from Hornsea Four to nearest marine border (km)
The Netherlands	79km
Germany	222km
Belgium	231km
Denmark	235km
Norway	247km
France	259km
Iceland	1,150km

Hornsea Four

Hornsea Four and Relevant Jurisdictional Boundaries Figure 1



- Scoping Boundary
- Array Area
- Exclusive Economic Zones
- Territotiral Waters Median Line



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Scale@A3: 1:2816954

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0 10 20 40 60 Nautical Miles

Hornsea Four and Relevant Jurisdictional Boundaries
Document no: H4SR_AN03
Created by: LS
Checked by: CC
Approved by: LK

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1.4 Consultation

1.4.1.1 Hornsea Four will conduct its pre-application consultation in accordance with the Planning Act 2008 plus associated guidance and Regulations, which includes the aforementioned 2017 Regulations. As part of this consultation, the following European Union (EU) ministries and industries will be consulted:

- Belgian ministries/representatives:
  - Flemish Government - Environment Nature and Energy Department;
  - Ministère de la Santé Publique et de l'Environnement;
  - Ministry of Brussels;
  - Federale Overheidsdienst Mobiliteit en Vervoer;
  - Royal Belgian Ship-owners Association;
  - Ministry of Wallonia;
  - Federal Public Service Health, Food Chain Safety and Environment; and
  - Rederscentrale.
- Danish ministries/representatives:
  - Danish Ministry of the Environment;
  - Danish Maritime Authority;
  - Danmarks Rederiforening;
  - Danmarks Fiskeriforening/ Danish Fishermen's Association;
  - Federal Ministry for the Environment Nature Conservation and Nuclear Safety; and
  - Sydvestjysk Fiskeriforening

.

- French ministries/representatives:
  - Ministère des Affaires étrangères;
  - Armateurs de France;
  - Préfecture Maritime de la Manche et de la Mer du Nord;
  - Secrétariat Général de la Mer;
  - FROM Nord; and
  - CME Organisation de Producteur.

- Dutch ministries/ representatives:
  - Ministry of Infrastructure and the Environment – Directorate General for Spatial Development and Water Affairs;
  - Rijkswaterstaat - Dutch Ministry of Infrastructure and Environment;
  - Rijkswaterstaat - Ministerie van Verkeer en Waterstaat;
  - Royal Association of Netherlands Ship Owners;
  - Ministry of Transport, Public Works and Water Management;
  - Policy Officer Nature and Spatial Planning - Dutch Fish Product Board; and
  - Vis Ned.

- Norwegian ministries/representatives:
  - Ministry of Environment; and
  - Norges Rederiforbund;Norwegian Maritime Directorate;Norwegian Fishing Vessel Owners Union.

- Portuguese ministries/representatives:
  - Ministère des Affaires étrangères.

- Republic of Ireland ministry/representatives:

- Department of Environment.
- Swedish ministries/representatives:
  - Implementation and Enforcement Department; and
  - Marine Standards Departments.

- German ministries/representatives:
  - German ministries/representatives;
  - Verband Deutscher Reeder;
  - Wasser-und Schifffahrtsverwaltung des Bundes; and
  - BSH Bundesamt für Seeschifffahrtund Hydrographie.

1.4.1.2 Hornsea Four will also consult with any additional consultees provided by the EU Ministries and Industries.

1.5 Offshore Physical and Biological Environment

1.5.1.1 Hornsea Four have completed a transboundary screening matrix for the offshore transboundary effects for the physical and biological environment, in line with the suggested format set out in the Annex 1 of PINS Advice Note 12. This screening matrix is set out in Table 2 below.

1.5.1.2 The conclusions of the transboundary screening for each physical and biological environment topic are presented, together with additional justification, in the following sections.

1.5.2 Marine processes

1.5.2.1 The offshore components of Hornsea Four lie outwith UK territorial waters with any impacts on marine processes, however, confined to a localised area within the footprint of the Hornsea Four array area and offshore Export Cable Corridor (ECC). There are no potential transboundary impacts upon marine processes anticipated. This is based on the current understanding of the baseline environment (e.g. sediment types and the tidal regime), along with the previous modelling work carried out for the Hornsea Project One, Hornsea Project Two and Hornsea Three EIAs, which were located closer than Hornsea Four to the boundaries with other member states. These assessments and modelling concluded that effects from sediment disturbance when installing foundations and cables were, and are, likely to be localised and of temporary duration due to resettlement of sediments. As a result, transboundary impacts are therefore not expected.

1.5.2.2 In conclusion, it is proposed that transboundary impacts upon marine processes are screened out of the EIA process.

1.5.3 Benthic and intertidal ecology

1.5.3.1 It is considered that there is no pathway by which direct or indirect effects arising from Hornsea Four could significantly affect the benthic or intertidal ecology of another EEA State. The extent of any predicted effects upon benthic and intertidal ecological receptors are likely to be limited in extent to the:

- Hornsea Four offshore development footprint (i.e. the Hornsea Four array area and offshore ECC) for temporary/long term habitat loss/disturbance and habitat modification (i.e. from the introduction of hard substrates); and

- One tidal excursion for suspended sediment/deposition assessments.

1.5.3.2 Therefore, it is concluded that no potential transboundary impacts upon the benthic and intertidal ecology are anticipated, which as a result means that transboundary impacts on the benthic and intertidal ecological receptors are screened out of the EIA process.

1.5.4 Fish and shellfish ecology

1.5.4.1 It is considered that there is potential for transboundary impacts upon fish and shellfish ecology due to the potential construction, operational and decommissioning impacts of Hornsea Four.

1.5.4.2 These include direct effects as a result of underwater noise from piling operations during the installation of subsea infrastructure. Indirect effects may occur in relation to fish and shellfish habitat or disturbance to habitat due to increased suspended sediment concentrations and deposition from the placement/removal of foundations and cables in or on the seabed.

1.5.4.3 These activities have the potential to directly affect Annex II migratory fish species that are listed as features of European Sites in other EEA States, or species that are of commercial importance for fishing fleets of other EEA States. The fish and shellfish species likely to be present in the Hornsea Four Scoping Boundary are outlined in full in Section 6.4 of the Hornsea Four Scoping Report (Fish and Shellfish Ecology), and include commercially important species such as whiting, dab, sprat, herring, plaice, mackerel and lemon sole. Herring and sandeel are of particular relevance when considering impacts to spawning areas as they are demersal spawners.

1.5.4.4 Indirect effects will include loss of, or disturbance to, fish spawning and nursery habitats in the North Sea that are for fish species of commercial importance to other EEA states as well as the behaviour of migratory fish species designated as Annex II species such as lamprey and Atlantic Salmon.

1.5.4.5 The fish and shellfish receptors likely to be present within Hornsea Four fish and shellfish study area are outlined in Section 6.4 of the Scoping Report (Fish and Shellfish Ecology), which also identifies the key spawning and nursery grounds for commercially important species located within and around the Hornsea Four array area and offshore ECC.

1.5.4.6 During construction the probability of impacts arising from underwater noise is high; modelling of the subsea noise generated by construction activities (piling) is not yet available but will be completed to support the EIA of effects on fish and shellfish ecology.

1.5.4.7 The potential effects associated with electromagnetic fields (EMF) and long-term habitat loss are, by nature, longer term but are spatially limited and considered unlikely to significantly effect species such that transboundary impacts will arise..

1.5.4.8 In conclusion, it is proposed that impacts on fish and shellfish ecology and their nature conservation interests, in so far as they are scoped into the main EIA process, will be also

be included within the transboundary assessment and are not screened out at this time. Any potential likely significant effects upon designated European Sites with fish as a qualifying feature will be assessed within the Habitats Regulations Assessment (HRA).

1.5.5 Marine Mammals

1.5.5.1 There is the potential for transboundary impacts upon marine mammals due to the mobile nature of marine mammal species and the proximity of Hornsea Four to the borders of surrounding EEA States, which are within migration ranges of certain species.

1.5.5.2 The marine mammal species likely to be present in the Hornsea Four marine mammal study area are outlined in full in Section 6.5 of the Hornsea Four Scoping Report (Marine Mammals), and include harbour porpoise Phocoena phocoena, minke whale Balaenoptera acutorostrata, white-beaked dolphin Lagenorhynchus albirostris, grey seal Halichoerus grypus and harbour seal Phoca vitulina.

1.5.5.3 Direct impacts may occur due to underwater noise generated during construction and decommissioning, particularly piling during the installation of foundations. Indirect impacts may case disturbance to prey (fish) species from loss of fish spawning and nursery habitat and suspended sediments and deposition. The operation and maintenance phase is considered less likely to result in significant transboundary impacts although the impacts associated with the operational noise of turbines and EMF are, by nature, longer term (although spatially limited) which will be reversible depending on the decommissioning strategy.

1.5.5.4 The probability of transboundary impacts to marine mammals occurring during construction, particularly as a result of underwater noise from piling, is potentially high although the extent cannot be determined at this stage and will be subject to assessment in the EIA. The majority of impacts during construction are however considered likely to be short term and temporary.

1.5.5.5 It is proposed that impacts upon marine mammals and their nature conservation interests, in so far as they are scoped into the main EIA process will also be subject to transboundary assessment and are not screened out at this time. Likely significant effects upon European Sites with marine mammals as qualifying features, will be assessed within the HRA.

1.5.6 Ornithology

1.5.6.1 There is the potential for transboundary impacts upon ornithological receptors (up to the Mean High Water Springs (MHWS) mark) due to the wide foraging and migratory ranges of typical bird species in the North Sea. In addition, a number of bird species that have been recorded during previous surveys include those that are listed as qualifying features of European Sites in other EEA States.

1.5.6.2 The bird species likely to be present in the Hornsea Four array area and offshore ECC, based on the outputs of the Hornsea Project One, Hornsea Project Two and Hornsea Three boat-based surveys, together with the site specific Hornsea Four aerial surveys, are outlined in full in Section 6.6 of the Hornsea Four Scoping Report (Offshore and Intertidal Ornithology), and include fulmar, gannet, kittiwake, guillemot, razorbill, puffin and Gulls.

1.5.6.3 They key direct effects for ornithological receptors are likely to arise during the operation and maintenance phase as a result of potential collisions (with rotating turbine blades which may result in direct mortality of individuals) and barrier effects (caused by the physical presence of structures which may prevent transit of birds between foraging and breeding sites, or on migration). Direct effects to ornithological receptors may, however, also occur as a result of temporary habitat loss/ disturbance across all development phases of Hornsea Four and permanent habitat loss during the operation and maintenance phase. Indirect impacts may cause disturbance to prey (fish) species from important bird feeding areas or changes to prey availability due to changes to physical processes and habitat as a result of the presence of operational infrastructure.

1.5.6.4 It is possible that there will be transboundary impacts to ornithological receptors occurring during operation and maintenance, particularly as a result of displacement and collision risk. The magnitude of these effects is not known at this stage and will be subject to further assessment in the EIA. Unlike the majority of impacts during the construction phase, which are considered likely to be short term and temporary, potential impacts during the operation and maintenance phase are likely to be long term, continuous and of varying spatial extent depending on the species, although it is likely that they will be reversible following the decommissioning of Hornsea Four.

1.5.6.5 In conclusion, it is proposed that there may be transboundary impacts upon birds and their nature conservation interests and these receptors will therefore be assessed further within the EIA and are not screened out at this time. Likely significant effects upon European Sites with birds as qualifying features, will be assessed within the HRA.

Table 2 - Offshore transboundary screening matrix for Hornsea Four - physical and biological environment

Screening Criteria	Marine Processes	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals	Ornithology
Characteristics of the Development For a detailed description, see Section 3 of the Hornsea Four Scoping Report (Project Description)	**Offshore** The proposed development is for an offshore generating station (wind farm) comprising of up to 180 wind turbines. A range of turbine models will be considered; however, it is anticipated that each turbine will have a maximum rotor diameter of 305m and a maximum blade tip height of 370m (Lowest Astronomical Tide (LAT)) (highest point of the structure). The minimum distance between the bottom of the blade and the water surface will be 35 m LAT. Foundation design has yet to be finalised with a final decision depending on final site investigation and procurement negotiations. The options under consideration include; steel monopile, a monopod suction caisson, a 3 or 4-legged suction caisson jacket, 3 or 4-legged piled jacket or a gravity base structure. Scour protection including rock and gravel dumping is being considered as part of the Project Description (Section 3 of the Hornsea Four Scoping Report). Up to 13 offshore platforms will be installed which, depending on the transmission system, may include an offshore converter substation and offshore booster substation, as well as offshore platforms supporting accommodation facilities for operation and maintenance. The exact number of platforms to be installed is yet to be determined. Subsea array cables, offshore interconnector cables and subsea export cables will be installed to connect the turbines to the substations and to connect the substations to the onshore transition pits at the landfall. Cable protection (type not specified) will also be installed. **Onshore** Export cables will connect the offshore cables to the onshore substation located at Creyke Beck.				
Geographical Area	The Hornsea Four array area is located approximately 65km east, at its closest point, of the coast of Yorkshire, and approximately 79km from the Dutch EEZ.				
Location of Development (including existing use)	The Hornsea Four array area is located within the former Hornsea Zone, which covers approximately 4,735 km^2.				
Cumulative Impacts	Section 10 of the Scoping Report	Section 10 of the Scoping Report	Section 10 of the Scoping Report	Section 10 of the Scoping Report	Section 10 of the Scoping Report
Carrier	No significant transboundary impacts are predicted	No significant transboundary impacts are predicted	See Section 1.4.3	See Section 1.4.4	See Section 1.4.5
Environmental Importance					
Extent			See Section 1.4.3	See Section 1.4.4	See Section 1.4.5
Magnitude	The magnitude of the impacts will be subject to the assessment to be undertaken for the EIA and have, therefore, not been determined here.				
Probability	No significant transboundary impacts are predicted.	No significant transboundary impacts are predicted.	See Section 1.4.3	See Section 1.4.4	See Section 1.4.5
Duration					
Frequency					
Reversibility					

1.6 Human Environment

1.6.1.1 Hornsea Four has completed a transboundary screening matrix for offshore transboundary effects for the human environment, in line with the suggested format set out in Annex 1 of PINS Advice Note 12. This screening is set out in Table 3 below.

1.6.1.2 The conclusions of the transboundary screening for each offshore human environment topic are presented, together with additional jurisdiction, in the following sections.

1.6.2 Commercial Fisheries

1.6.2.1 Commercial fishing operates in the Hornsea Four commercial fisheries study area as outlined in Section 6.8 of the Hornsea Four Scoping Report (Commercial Fisheries) and includes activity by a number of fleets from EEA States.

1.6.2.2 Due to the highly mobile nature of both commercial fish species and fishing fleets and the proximity of the Hornsea Four array area to Dutch, German and Danish waters (Figure 1), together with the known presence of Belgian, Dutch, Danish, French and German fishing vessels with the Hornsea Four area, there is the potential for transboundary impacts upon commercial fisheries to arise from two sources;

- Effects on commercial fishing fleets as a result of impacts from Hornsea Four on commercial fish stocks in the waters of other EEA States; and

- Effects on commercial fishing fleets from all EEA countries as a result of constraints on foreign commercial fishing activities operating in Hornsea Four, including demersal trawling, beam trawling, demersal seining and other gears. These effects may include reduction in access to fishing grounds and potential displacement of fishing effort from Hornsea Four to alternative fishing grounds in other EEA States, which will have direct implications to that fishing ground.

1.6.2.3 The probability of impacts occurring during operation, particularly as a result of the presence of the offshore infrastructure associated with Hornsea Four, is likely to be high although the extent cannot be determined at this stage. This will be determined by the final project design and the description of final designated safety zones and will therefore be subject to assessment in the EIA.

1.6.2.4 Although such effects have the potential to be long term, it is likely that following completion of construction that some fishing activity may be able to resume, depending upon the final design of the infrastructure. In addition, it is likely that any impact from the final installed design would be reversible after decommissioning, as it is anticipated that all structures above the seabed will be completely removed and fishing activity would be able to resume once decommissioning is completed. The construction phase is considered less likely to result in significant effects although the effect associated with the interference caused by the presence of infrastructure will progressively increase as the development is progressed.

1.6.2.5 Therefore, it is proposed that transboundary impacts upon commercial fisheries are assessed further within the EIA and are not screened out at this time.

1.6.3 Shipping and Navigation

1.6.3.1 Hornsea Four is situated in the Southern North Sea where some of the busiest shipping routes presently operate. The shipping and navigation baseline for the Hornsea Four array area and the offshore ECC are outlined in Section 6.9 of the Hornsea Four Scoping Report (Shipping and Navigation).

1.6.3.2 Therefore, there is the potential for transboundary impacts upon shipping routes which transit to/from other EEA countries including the potential effects of shipping routes to/from The Netherlands, Denmark, Sweden, Iceland and Germany. Transboundary issues could also arise from impacts upon international ports, other international shipping routes and/or routes affected by other international offshore renewable energy developments.

1.6.3.3 Routes transiting between Humber and Germany will have to align with proposed traffic routeing being developed by the German government for its own offshore renewable energy development. However due to the presence of International Maritime Organization (IMO) routeing measures (in particular the Off Botney Ground Traffic Separation System), traffic will already have to align prior to the approach to German waters.

1.6.3.4 The probability of effects on shipping and navigation occurring during operation, particularly as a result of the presence of the offshore infrastructure associated with Hornsea Four, is likely to be high although the significance of those effects cannot be determined at this stage. This will be subject to assessment in the EIA. Although such effects would be long term, it is likely that they would be reversible after decommissioning, as it is anticipated that all structures above the seabed will be completely removed. The construction phase is considered less likely to result in significant effects although the effects associated with the interference caused by the presence of infrastructure on shipping and navigation will progressively increase as the development is progressed.

1.6.3.5 Therefore, it is proposed that transboundary impacts upon shipping and navigation are assessed further within the EIA and are not screened out at this time.

1.6.4 Aviation and Radar

1.6.4.1 The aviation and radar baseline for the Hornsea Four array area and the offshore ECC are outlined in Section 6.10 of the Hornsea Four Scoping Report (Aviation and Radar).

1.6.4.2 Potential effects upon aviation during the operation and maintenance phase include potential disturbance to commercial helicopter transiting to oil and gas installations in the Southern North Sea from UK airports. There are some platforms within the vicinity of Hornsea Four that are located in the Dutch EEZ, however, these platforms are serviced from The Netherlands (i.e. from the east) and therefore no transboundary effects are predicted in relation to disruption to transit routes to the set platforms and use of available airspace. Hornsea Four is entirely within the UK Flight Information Region and therefore no transboundary effects are predicted in relation to aviation airspace.

1.6.4.3 There is the potential for transboundary impacts to arise from the presence of the wind turbines during the operation and maintenance during disrupting civil and military radar coverage from The Netherlands. The probability of impacts occurring during the operation and maintenance phase as a result of the presence of the offshore infrastructure associated with Hornsea Four is likely to be high, although the extent cannot be determined at this stage. This will be determined once all the baseline data has been obtained for the Dutch sector, and once the project description has been further refined. Although such effects would be long term, it is likely that they would be reversible after decommissioning, as it is anticipated that all structures above the seabed will be completely removed. These potential impacts will therefore be subject to assessment in the EIA.

1.6.4.4 Therefore, it is proposed that transboundary impacts upon aviation and radar and military during the operational and maintenance phase are assessed further within the EIA and are not screened out at this time.

1.6.5 Marine Archaeology

1.6.5.1 The marine archaeology baseline for the Hornsea Four array area and the offshore ECC are outlined in full in paragraphs in Section 6.7 of the Hornsea Four Scoping Report (Marine Archaeology).

1.6.5.2 The extent of any predicted impacts upon marine archaeology receptors are likely to be limited in extent to the:

- Hornsea Four offshore footprint (i.e. the Hornsea Four array area and offshore ECC) for impacts associated with direct physical seabed disturbance; and
- One tidal excursion for impacts associated with sediment deposition on the seabed.

1.6.5.3 Therefore, no potential transboundary impacts upon marine archaeology are anticipated and it is proposed that transboundary impacts on marine archaeology are screened out of the EIA process.

1.6.6 Seascape and Visual Resources

1.6.6.1 The seascape and visual resources baselines for the Hornsea Four array area and the offshore ECC corridor are outlined in full Section 6.11 of the Hornsea Four Scoping Report (Seascape and Visual Resources).

1.6.6.2 The only impact which has been screened into the assessment is the introduction of new/uncharacteristic elements/features and potential effects on the existing Historic Seascape Characteristic (HSC). The extent of any predicted impacts upon the HSC is therefore likely to be largely focused on the Hornsea Four offshore footprint (i.e. the Hornsea Four array area and the offshore ECC).

1.6.6.3 Therefore, no potential transboundary impacts upon seascape and visual resources are anticipated and it is proposed that transboundary impacts on seascape and visual resources are screened out of the EIA process.

1.6.7 Infrastructure and other users

1.6.7.1 The baseline for infrastructure and other users for the Hornsea Four array area and the offshore ECC are outlined in full in Section 6.12 of the Hornsea Four Scoping Report (Infrastructure and Other Users).

1.6.7.2 Potential impacts upon infrastructure and other users from other EEA States are limited to activities surrounding oil and gas operations. There is the potential for transboundary impacts to arise from the piling of the wind turbine and substation foundations during the construction phase, which may interfere with seismic survey operations in the Dutch EEZ.

1.6.7.3 However, given the distance of Hornsea Four from the Dutch EEZ (minimum 79km) it is considered unlikely that subsea noise from piling at Hornsea Four would intrude into the Dutch EEZ at a level sufficient to affect seismic operations and as such it is proposed to screen this potential transboundary effect out of the EIA process

1.6.7.4 There is the potential for transboundary impacts to also arise during the operation and maintenance phase from the presence of the Hornsea Three wind turbines causing interference with the performance of Radar Early Warning Systems (REWS) located on gas platforms in the Dutch sector of the Southern North Sea. However, given the distance of Hornsea Four from the Dutch EEZ (minimum 79km) and the closest platforms in Dutch waters it is considered unlikely that the operation of REWS would be affected and as such it is proposed to screen this potential transboundary effect out of the EIA process

Table 3 - Offshore transboundary screening matrix for Hornsea Four - human environment

Screening Criteria	Commercial Fisheries	Shipping and Navigation	Aviation and Radar	Marine Archaeology	Seascape and Visual Resources	Infrastructure and Other Users
Characteristics of the Development	See Table 2 for details.					
Geographical Area	See Table 2 for details.					
Location of Development (including existing use)	See Table 2 for details.					
Cumulative Impacts	Section 10 of the Scoping Report	Section 10 of the Scoping Report	Section 10 of the Scoping Report	Section 10 of the Scoping Report	Section 10 of the Scoping Report	Section 1 of the Scoping Report
Carrier Environmental Importance Extent	See Section 1.5.1	See Section 1.5.2	See Section 1.5.3	No significant transboundary impacts are predicted.	No significant transboundary impacts are predicted.	No significant transboundary impacts are predicted.
Magnitude	The magnitude of the impacts will be subject to the assessment to be undertaken for the EIA and have, therefore, not been determined here.					
Probability Duration Frequency Reversibility	See Section 1.5.1	See Section 1.5.2	See Section 1.5.3	No significant transboundary impacts are predicted.	No significant transboundary impacts are predicted.	No significant transboundary impacts are predicted.

1.6.8 Onshore Environment

1.6.8.1 Hornsea Four have completed a transboundary screening matrix for onshore transboundary effects, in line with the suggested format set out in Annex 1 of PINS Advice Note 12. This screening matrix is set out in Table 4 below.

1.6.8.2 The conclusion of the transboundary screening for each onshore topic are presented, together with additional justification, in the following sections.

1.6.9 Geology and Ground Conditions

1.6.9.1 Any impacts on geology and ground conditions arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area within the footprint of the Hornsea Four onshore ECC. There is no pathway by which direct or indirect effects arising from the Hornsea Four could significantly affect the geology or ground conditions of another member state.

1.6.9.2 It is therefore proposed that transboundary impacts on geology and ground conditions are screened out of the EIA process.

1.6.10 Hydrology and Flood Risk

1.6.10.1 Any impacts on hydrology and flood risk arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area with the footprint of the Hornsea Four onshore ECC. There is no pathway by which direct or indirect effects from arising from Hornsea Four could significantly affect the hydrology and flood risk of another member state.

1.6.10.2 It is therefore proposed that transboundary impacts on hydrology and flood risk are screened out of the EIA process.

1.6.11 Onshore Ecology and Nature Conservation

1.6.11.1 Any impacts on onshore ecology and nature conservation arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area within the footprint of the Hornsea Four onshore ECC corridor. There is no pathway by which direct and indirect effects arising from Hornsea Four could significantly affect the onshore ecology and nature conservation of another member state including those that are listed as qualifying features of European Sites in other EEA states

1.6.11.2 It is therefore proposed that transboundary impacts on onshore ecology and nature conservation are screened out of the EIA process.

1.6.12 Traffic and Transport

1.6.12.1 Any impacts on the traffic and transport arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area of the UK road infrastructure. There is no pathway by which direct or indirect effects arising from Hornsea Four could significantly affect traffic and transport in another member state.

1.6.12.2 It is therefore proposed that transboundary impacts on traffic and transport are screened out of the EIA process.

1.6.13 Historic Environment

1.6.13.1 Any impacts on the onshore historic environment arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area within the direct or indirect effects arising from Hornsea Four could significantly affect the onshore historic environment of another member state.

1.6.13.2 It is therefore proposed that transboundary impacts on the onshore historic environment are screened out of the EIA process.

1.6.14 Landscape and Visual Resources

1.6.14.1 Any impacts on landscape and visual resources arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area in the vicinity of the Hornsea Four onshore ECC. There is no pathway by which direct or indirect effects arising from Hornsea Four could significantly the landscape and visual resources of another member state.

1.6.14.2 It is therefore proposed that transboundary impacts on landscape and visual resources are screened out of the EIA process.

1.6.15 Land Use, Agriculture and Recreation

1.6.15.1 Any impacts on land use, agriculture and recreation arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area within the footprint of the Hornsea Four onshore ECC. There is no pathway by which direct or indirect effects arising from Hornsea Four could significantly affect the land use, agriculture and recreation of another member state.

1.6.15.2 It is therefore proposed that transboundary impacts on noise and vibration are screened out of the EIA process.

1.6.16 Noise and Vibration

1.6.16.1 Any noise and vibration impacts arising from the construction, operation and maintenance and decommissioning of Hornsea Four will be confined to a localised area in the vicinity of the Hornsea Four onshore ECC. There is no pathway by which direct or indirect effects arising from Hornsea Four could result in significant noise and vibration effects in another member state.

1.6.16.2 It is therefore proposed that transboundary impacts on noise and vibration are screened out of the EIA process.

1.6.17 Air Quality and Health

1.6.17.1 Potential transboundary impacts to air quality and health arising from the construction, operation and maintenance and decommissioning of Hornsea Four are anticipated to be minor and localised in extent and will be confined to the duration of the construction phase only. Any potential impacts to health related to air quality will also be localised and confined to the onshore construction phase. Potential transboundary health impacts due to the generation of an EMF around the onshore ECC will be confined to the immediate vicinity of the onshore ECC.

1.6.17.2 It is therefore proposed that transboundary impacts on air quality and health are screened out of the EIA process.

1.6.18 Socio-economic Aspects

1.6.18.1 The socio-economic baseline for the Hornsea Four array area and the offshore ECC are outlined in full in Section 7.10 of the Hornsea Four Scoping Report (Socio-economic Characteristics).

1.6.18.2 There is the potential for transboundary impacts arising from interaction with the activities of foreign shipping and navigation and foreign commercial fishing. These have been considered in Section 1.5.2 and 1.6.2, respectively.

1.6.18.3 In addition, potential transboundary impacts upon the economies of other EEA states may arise through the purchase of project components, equipment and the sourcing of labour from companies based outside the UK. Under Regulation 32 part 6(a) of the 2017 Regulations, the Secretary of State must enter into consultation with any EEA State concerned regarding the potential significant effects of the development on the environment of that EEA State and the measures envisaged to reduce or eliminate such effects. However, the sourcing of materials and labour from other EEA states is assumed to provide beneficial effects in the economies of such states and so the consideration of "measures envisaged to reduce or eliminate such effects" is not relevant in the context of transboundary impacts.

1.6.18.4 It is therefore proposed that transboundary impacts on socio-economic receptors, other than commercial fisheries and marine transport, are screened out of the EIA process.

Table 4 - Onshore transboundary screening matrix for Hornsea Four

Screening Criteria	Geology and Ground Conditions	Hydrology and Flood Risk	Onshore Ecology and Nature Conservation	Traffic and Transport	Historic Environment	Landscape and Visual Resources	Land Use, Agriculture Recreation	Noise and Vibration	Air Quality and Health	Socio-economic Characteristics
Characteristic of the Development For a detailed description of the development, see Section 3 of the Hornsea Four Scoping Report (Project Description)	Onshore transition pits will connect the wind farm to an onshore substation. An onshore ECC, with jointing pits will then connect the substation to Creyke Beck Substation, an existing 400 kV substation located in Yorkshire, which is owned by National Grid.									
Geographical Area [1]	N/A									The Hornsea Four array area is located approximately 65km east from the coast of Yorkshire, and 79km from the Dutch EEZ.
Location of Development (including existing use)	The offshore export cable will make landfall on the Yorkshire coast with the onshore cable route extending to Creyke Beck Substation located in Yorkshire.									
Cumulative Impacts	No significant transboundary impacts are predicted.									
Carrier										
Environmental Importance										
Extent										
Magnitude										
Probability										
Duration										
Frequency										
Reversibility										

[1] 'Geographical Area' here refers to the geographical area(s) within the jurisdiction of other EEA member states that will suffer potential impacts from the development. This transboundary impacts review note concludes that there will be no significant impacts from Hornsea Four on onshore receptors.

1.7 Conclusions

1.7.1.1 This screening annex has been prepared in accordance with PINS Advice Note 12. The primary purpose of this note is to provide a screening assessment of potential transboundary impacts which have the potential to affect other EEA States.

1.7.1.2 On the basis of the current information available, as detailed within the Hornsea Four Scoping Report, the possibility of likely significant effect on the interest of another EEA states cannot be ruled out at this stage. Transboundary impacts have therefore been screened into the EIA process for the following topics:

- Fish and Shellfish Ecology;
- Marine Mammals;
- Ornithology;
- Commercial Fisheries;
- Shipping and Navigation; and
- Aviation and Radar.

1.8 References

1.8.1.1 PINS (2015). PINS Advice Note 12. Transboundary Impacts and Process. March 2018. Version 5.

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Annex L Onshore Cumulative Screened Projects

	Application Reference	Name of Proposed Development	Location description (relative to HOW04)	Description of Proposed Development	Local Authority	Status/ Consent	Sources of Information	Date of application submission	Screening Comments
1		A63 Castle Street Improvement-Hull	Approximately 7km of most southernly point of scoping boundary, just north of Cottingham.	Improvement of a 1.5km stretch of the A63 at Castle Street by lowering the level of the road into a cutting by approximately 7m at Mytongate Junction. Ferensway and Commercial Road would pass over, being raised by approximately 1m, creating a split level junction. The project will also widen the eastbound carriageway to three lanes between Mytongate and Market Place, with the nearside lane being marked for local traffic.	Kingston upon Hull	Pre-application	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/a63-castle-street-improvement-hull/?ipcsection=overview	01-Sep-18	**Screened in. Located within impact zone and potential for temporal interaction with Hornsea Four.**
2		Drax Re-power	Approximately 35km west of the scoping boundary.	Drax Power Ltd is proposing to modify up to two of the coal-fired generating units (known as Units 5 and 6) at Drax Power Station, Selby, to become gas-powered generating plant. The proposed Project comprises up to four new combined cycle gas turbines (CCGT) (up to two for Unit 5 and up to two for Unit 6), each powering a dedicated generator of up to 600MW in capacity. Each Unit would provide steam to the existing steam turbine for that Unit which would generate up to 600MW per Unit.	North Yorkshire	Pre-examination	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/drax-re-power/	No later than 3 months after Wednesday 29th August 2018	Screened out. Located outwith impact zone.
3		Eggborough CCGT	Approximately 44km west of the scoping boundary.	The construction and operation of a new CCGT generating station with a capacity of up to 2,500 MW new gas pipeline to the National Transmission System and other associated development.	North Yorkshire	Pre-application	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/eggborough-ccgt/	The Examining Authority issued a Recommendation Report to the Secretary of State on 27 June 2018. The Secretary of State has three months in which to issue a decision	Screened out. Located outwith impact zone.
4		Dogger Bank Creyke Beck	Onshore elements of the project (substation, onshore export cable route and landfall) are all located within 0-2km of Hornsea Four.	Dogger Bank Creyke Beck (previously known as Dogger Bank Offshore Wind Farm) is the first stage of Forewind's offshore wind energy development of the Dogger Bank Zone (Zone 3, Round 3). It will comprise two wind farms, each with an installed capacity of up to 1.2GW, which are expected to connect to the national grid in the East Riding of Yorkshire. Therefore, Dogger Bank Creyke Beck could have a total installed capacity of up to 2.4GW. The offshore wind farms will be located in the Dogger Bank Zone which is located between 125 to 290km off the coast of East Yorkshire. The onshore elements of the development will be located in the East Riding of Yorkshire.	East Riding of Yorkshire	Authorised	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/dogger-bank-creyke-beck/	2015	**Screened in. Onshore elements of this project are located within impact zone and potential for temporal interaction with Hornsea Four as application due to be submitted Q4 2018.**
5		Dogger Bank Teesside A / Sofia Offshore Wind Farm (formerly Dogger Bank Teesside B) - Project previously known as Dogger Bank Teesside A&B	Windfarm located 131km offshore. The converter station would be north of the A1709 between Beverley and Cottingham in the East Riding of Yorkshire. The cable route would then connect to the National Grid at the existing substation at Creyke Beck. Cable landing point is between Barmstone and Ulrome.	Dogger Bank Teesside A & B (previously part of Dogger Bank Teesside) is the second stage of Forewind's offshore wind energy development of the Dogger Bank Zone (Zone 3, Round 3). Dogger Bank Teesside A & B will comprise up to two wind farms, each with an installed capacity of up to 1.2GW, which are expected to connect to the national grid at the existing national grid substation at Lackenby, near Eston. It follows that Dogger Bank Teesside A & B could have a total installed capacity of up to 2.4GW Dogger Bank Teesside A & B is located within The Dogger Bank Zone which comprises an area of 8660 square kilometres (km2) located in the North Sea between 125 kilometres (km) and 290km off the UK North East coast. The onshore elements of the development will be located in the Borough of Redcar and Cleveland. The documents for this project are held in the section of the website relevant to projects in Yorkshire and the Humber, together with other offshore projects relating to Dogger Bank. Regions are used on this website as an organisational convenience and do not represent any administrative or legal boundaries. Some organisations include land in the Borough of Redcar and Cleveland in the North East region. If you intend to refer to regionalised organisations, initiatives or information during the examination, please ensure that you identify the appropriate region for your purposes.	East Riding of Yorkshire	Authorised	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/dogger-bank-teesside-a-sofia-offshore-wind-farm-formerly-dogger-bank-teesside-b-project-previously-known-as-dogger-bank-teesside-ab/	01-Jul-14	Screened out. Located outwith impact zone.
6		Knottingley Power Project	Approximately 53km west of the scoping boundary and the village of Walkington.	A 1500 MW Combined Cycle Gas Turbine (CCGT) power station and associated infrastructure.	North Yorkshire	Correction notice 2016	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/knottingley-power-project/	06-Jul-05	Screened out. Located outwith impact zone.
7		Yorkshire and Humber CCS Cross Country Pipeline	The pipeline will be routed from the proposed White Rose CCS Project (Drax, North Yorkshire) via proposed multi-junction at Camblesforth (North Yorkshire) to a land fall point near Barmston (East Riding of Yorkshire).	The Yorkshire and Humber CCS Cross Country Pipeline will comprise the construction of approximately a 75km onshore pipeline and associated infrastructure for the transportation of carbon dioxide. The application will include associated infrastructure comprising pipeline internal gauge (PIG) traps, a multi-junction, three block valves, a pumping station and associated works.	North Yorkshire and East Riding of Yorkshire Council	Refused	http://infrastructure.planningportal.gov.uk/	04-Jul-16	Screened out. Planning application refused.
8		River Humber Gas Pipeline Replacement Project	Approximately 14km north-east of the scoping boundary's most southerly point.	The replacement of a 42 natural gas transmission pipeline, housed within a tunnel beneath the Humber Estuary commencing approximately 3.2km north east of Goxhill, North Lincolnshire, terminating approximately 1.6km south east of Paull, East Riding of Yorkshire. Under construction and anticipated to be complete by May 2019.	North Yorkshire and East Riding of Yorkshire Council	Authorised	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/river-humber-gas-pipeline-replacement-project/	01-Aug-16	Screened out. Located outwith impact zone, and outside the timeframe of Hornsea Four.
9		Ferrybridge D Combined Cycle Gas Turbine (CCGT) Power Station Project	Approximately 56km west of the scoping boundary.	A new CCGT generating station of circa 2000 MW output capacity and associated development including a gas supply pipeline to the National Transmission System for gas.	East Riding of Yorkshire	Pre-application	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/ferrybridge-d-combined-cycle-gas-turbine-ccgt-power-station-project/	Expected Q1 2019	Screened out. Located outwith impact zone.

	Application Reference	Name of Proposed Development	Location description (relative to HOW04)	Description of Proposed Development	Local Authority	Status/ Consent	Sources of Information	Date of application submission	Screening Comments
10		Thorpe Marsh Gas Pipeline	Approximately 41km south-west of the scoping boundary.	The Proposed Gas Pipeline will be a continuously welded buried steel pipeline of approximately 18km in length from an offtake approximately 1.5km west of Camblesforth to the Thorpe Marsh CCGT Power Station site. It will include the following elements: A Minimum Off-take Connection (MOC) to the National Transmission System (NTS) to be constructed and operated by the National Grid; Offtake Above Ground Installation (AGI), adjacent to the National Grid offtake, which will contain pipeline control valves and Pipeline Internal Gauging (PIG) pigging facilities; A cross-country pipeline between the offtake AGI and the proposed CCGT Power Station; and A Gas Reception Facility (GRF) at the power station within the power station site which will contain pipeline control valves and pipeline pigging facilities. N.B. the GRF has existing planning consent under the Electricity Act 1989 Section 36 as it is within the power station "Red Line" development area.	North Yorkshire	Authorised	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/thorpe-marsh-gas-pipeline/	Nov-14	Screened out. Located outwith impact zone, and outside the timeframe of Hornsea Four.
11		White Rose Carbon Capture and Storage Project	Approximately 34km west of the scoping boundary.	A 448 MWe coal fired power station with carbon capture equipment. The main components of the development will include an Oxy Fuel pulverized coal boiler, turbine-generator unit, air separation unit, flue gas desulphurization plant, gas condenser plant and carbon dioxide capture system together with associated development.	North Yorkshire	Refused	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/white-rose-carbon-capture-and-storage-project/	Nov-14	Screened out. Planning application refused.
12		North Killingholme Power Project	Approximately 13km south-east of the scoping boundary's most southerly point. Land west of Humber Sea Terminal.	The proposal is for a new thermal generating station that will operate either as a Combined Cycle Gas Turbine (CCGT) plant or as an Integrated Gasification Combined Cycle (IGCC) plant, with a total electrical output of up to 470MWe	North Yorkshire and East Riding of Yorkshire Council	Correction order and notice 2014	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/north-killingholme-power-project/	Mar-13	Screened out. Located outwith impact zone, and outside the timeframe of Hornsea Four.
13		North Doncaster Rail Chord (near Shaftholme)	Approximately 34km south-west of the scoping boundary.	The proposed development comprises the construction of a new 3.2km long twin track railway constructed partly on embankment and partly on a new 246m long viaduct which will span the East Coast Mainline Railway and Joan Croft Lane. The proposed development will also include the construction of a permanent highway overbridge over the ECML to allow the closure of the Joan Croft level crossing and other associated works. This closure will enable the new railway line to be lower than it would otherwise have to be.	North Yorkshire and East Riding of Yorkshire Council	Authorised	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/north-doncaster-rail-chord-near-shaftholme/	Jun-11	Screened out. Located outwith impact zone, and outside the timeframe of Hornsea Four.
14		Ferrybridge Multifuel 2 (FM2) Power Station	Approximately 53km south-west of the scoping boundary.	Proposed multifuel generating station with a capacity of up to 90 MWe Gross, capable of producing low carbon electricity and heat primarily through waste derived fuel from various sources of processed municipal solid waste, commercial and industrial waste and waste wood. The site is located at Former Golf Course within the site of Ferrybridge Power Station.	West Yorkshire	Non-material consent order January 2018	https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/ferrybridge-multifuel-2-fm2-power-station/	Jul-14	Screened out. Located outwith impact zone, and outside the timeframe of Hornsea Four.
15	15/00850/AGNOT	Monument Farm Agricultural Developments	South of indicative cable centreline, within 700m temporary works area.	Erection of a livestock building.	East Riding of Yorkshire Council	Prior approval not required	http://www2.eastriding.gov.uk/	Mar-15	Screened out. Small scale and likely to be outside the timeframe of Hornsea Four.
16	16/04012/PLF	Monument Farm Agricultural Developments	South of indicative cable centreline, within 700m temporary works area.	Erection of a storage building.	East Riding of Yorkshire Council	Prior approval not required	http://www2.eastriding.gov.uk/	Nov-16	Screened out. Small scale and likely to be outside the timeframe of Hornsea Four.
17	15/00851/PLF	Monument Farm Agricultural Developments	South of indicative cable centreline, within 700m temporary works area.	Erection of a general purpose agricultural storage building.	East Riding of Yorkshire Council	Prior approval not required	http://www2.eastriding.gov.uk/	Mar-15	Screened out. Small scale and likely to be outside the timeframe of Hornsea Four.
18	16/03220/VAR	Skipsea Beach and Social Club	North of indicative cable centreline, close to landfall, within 700m temporary works area.	Variation of Condition 3 (lighting), Condition 4 (ventilation/ extraction) and Condition 6 (demolition works) of planning reference 14/02221/PLF - Erection of a replacement social club and manager's accommodation following demolition of existing social club to allow roll back from eroding coastline - to allow for the installation of lighting and kitchen at a later date and the new clubhouse to be in use before the demolition and removal of the existing clubhouse.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Sep-16	Screened out. Small scale and likely to be outside the timeframe of Hornsea Four.
19	15/01436/PLF	Solar panel installation Gembling House	North of indicative cable centreline, within 700m temporary works area.	Installation of ground mounted solar panels and associated infrastructure.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	not provided	Screened out. Small scale.
20	17/01452/PLF	Northfield Lane Agricultural Developments	Approximately 350m south of indicative cable centreline, within 700m temporary works area.	Erection of agricultural livestock building following demolition of existing.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	not provided	Screened out. Small scale.
21	14/01664/STPLF	Elm Tree Farm Substation and Access Track	Substation is located approximately 250m south of indicative cable centreline. Construction access tracks due to extend west and north outside of the 700m temporary works area.	Erection of a substation building and construction of an access track in connection with approved wind turbine.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	May-14	Screened out. Small scale and likely to be outside the timeframe of Hornsea Four.
22	13/03606/STPLFE	Rotsea Wind Farm Turbines	Hornsea Four ECC travels directly through planning application boundary. Planning application boundary extends to the east and west, outside of the 700m temporary works area.	Erection of 3 no. wind turbines (130.5m to tip), 1 no. communications mast, permanent sodar/LIDAR wind monitoring compound, access tracks and associated infrastructure, temporary works include: construction of compound, access tracks and turning heads, welfare facilities and 2 no. guyed meteorological masts (80m high).	East Riding of Yorkshire Council	Application refused	http://www2.eastriding.gov.uk/	Oct-13	Screened out. Planning application refused.

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23	13/01063/EIASCO	Rotsea Wind Farm Scoping Request	Hornsea Four ECC travels directly through planning application boundary. Planning application boundary extends to the east and west, outside of the 700m temporary works area.	EIA Scoping Opinion	East Riding of Yorkshire Council	Enquiry Answered	http://www2.eastriding.gov.uk/	Mar-13	Screened out. Planning application refused.
24	16/01112/PLF	Blue Keld Springs Surface Water Drainage Works	Located south of the planning application boundary for Rotsea Windfarm, north of the indicative cable centreline within the 700m temporary works area.	Submission of details required by Condition 3 (surface water drainage works) of planning permission.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Dec-16	Screened out. Small scale, likely to be outside the timeframe of Hornsea Four.
25	14/01678/STPLF	Bridge House Wind Farm Associated Facilities	Located north-east of indicative cable centreline, outside of the 700m temporary works area. Associated infrastructure including electricity cable will travel within 700m temporary works area.	Erection of a substation building and underground electricity cable in association with previously approved wind turbine.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	May-14	Screened out. Small scale, likely to be outside the timeframe of Hornsea Four.
26	13/03715/STPLF	Manor Farm Wind Turbine	Located south-east of the indicative cable centreline, just outside of the 700m temporary works area.	Erection of a wind turbine (65m to blade tip, 38m to hub (above ground level)) and associated infrastructure.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Nov-13	Screened out. Small scale, likely to be outside the timeframe of Hornsea Four.
27	14/04028/PLF	Wood House Wind Turbines	Indicative cable centreline travels through planning application boundary of wind turbines and associated infrastructure.	Installation of 2no. wind turbines (30.52m to hub, 48.01m to tip, 34.97m rotor diameter) and associated infrastructure including control kiosk and access	East Riding of Yorkshire Council	Refused	http://www2.eastriding.gov.uk/	Dec-14	Screened out. Planning application refused.
28	15/01822/PLF	Wood House Wind Turbines	Indicative cable centreline travels through planning application boundary of wind turbines and associated infrastructure.	Erection of a wind turbine (48.4m high to tip, 36.6m high to hub, 23.5m rotor diameter) and associated infrastructure	East Riding of Yorkshire Council	Refused	http://www2.eastriding.gov.uk/	Jun-15	Screened out. Planning application refused.
29	17/02645/STPLF	Teckno Developments Site	Works on building and boundary fence border on the western side of the 700m temporary works area, south of the A1035.	Erection of a building for Business (B1), General Industry (B2) and Storage/Distribution (B8) uses and erection of boundary fence.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Aug-17	Screened out. Small scale, likely to be outside the timeframe of Hornsea Four.
30	15/02305/PLF	Lazaat Restaurant Single Storey Extension and associated works	Works are located directly adjacent to the A164 and within substation search area.	Erection of single storey extension and alterations to extend toilet facilities.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Jul-15	Screened out. Small scale, likely to be outside the timeframe of Hornsea Four.
31	17/01205/STVAR	Oaklands Park Non-Material Amendment to Planning Approval 17/01205/STVAR and works to associated facilities	Works are located within substation search area.	Removal of a central section of the engine block which contained control gear (reduction in footprint), control gear now housed inside a separate switch house, a new smaller electrical infrastructure compound, re-alignment of the 132kV substation, larger balancing pond, amendment to the layout of internal access roads including a spur road to the adjacent battery storage facility, re-positioning of the site welfare and storage shipping containers, CCTV positioning, landscaping works and re-positioning of the security fencing.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Feb-18	Screened out. Small scale, likely to be outside the timeframe of Hornsea Four.
32	18/30161/CONDET	Oaklands Park Associated Works	Works are located within substation search area.	Submission of details as required by Condition 3 (battery cabin, MVPS containers, compound and fencing), Condition 5 (Construction Environmental Management Plan), Condition 7 (flood flow routes), Condition 8 (flood flow routes), Condition 10 (surface water drainage), Condition 11 (Environmental Management Plan), Condition 13 (Construction Traffic Management Plan), Condition 14 (passing place) and Condition 15 (archaeology) of planning application 17/01372/STPLF	East Riding of Yorkshire Council	Pending/Under consideration	http://www2.eastriding.gov.uk/	Apr-18	Screened out. Small scale, likely to be outside the timeframe of Hornsea Four.
33	16/02262/EIASCR	Creyke Beck Substation 4875 Park Lane	Works are located within substation search area.	Screening Opinion - Proposed Gas Fired Energy Reserve Facility	East Riding of Yorkshire Council	Enquiry Answered	http://www2.eastriding.gov.uk/	Jun-16	**Screened in. Onshore elements of this project are located within impact zone and potential for temporal interaction with Hornsea Four as application due to be submitted Q4 2018. [onshore elements of project screened in above: 4]**
34	17/01993/STPLF	Lawns Farm Park Battery Storage	Works are located east of substation search area, just outside the scoping boundary.	Construction of a 49.5MW Battery Storage Facility (17 battery units) with associated infrastructure and landscaping.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Jul-15	**Screened in. Within impact zone, possible temporal overlap and in close proximity to substation.**
35	17/00920/EIASCR	Lawns Farm Park Battery Storage	Works are located east of substation search area, just outside the scoping boundary.	Screening Opinion - Proposed Battery Storage Development	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Feb-18	**Screened in. Within impact zone, possible temporal overlap and in close proximity to substation.**
36	15/04027/EIASCR	Bramble Hill Farm Anaerobic Digestion Plant	Works are located adjacent to the A1079, within the substation search area.	EIA Screening Opinion - Proposed Anaerobic Digestion Plant	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Apr-18	**Screened in. Within impact zone, possible temporal overlap and in close proximity to substation.**
37	18/01846/EIASCR	Jocks Lodge Highway Improvement Scheme	Works occurring on the A1079 within substation search area and in close proximity to the north-east of the indicative 700m temporary works area.	EIA Screening Opinion - A164 and Jocks Lodge Highway Improvement Scheme. The construction period will be around 24 months, with an anticipated finish date of 2022/23.	East Riding of Yorkshire Council	Enquiry Answered	http://www2.eastriding.gov.uk/	Jun-18	**Screened in. Located within impact zone and potential for temporal interaction with Hornsea Four.**
38	15/03764/STPLF	Lincoln Way Dwellings	Residential area works and associated facilities exist north of the Jocks Lodge Interchange, immediately north of substation search area in Beverley.	Erection of 100 dwellings with access to Lincoln Way, associated infrastructure and open space.	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Jun-17	**Screened in. Located within impact zone and potential for temporal interaction with Hornsea Four.**

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39	16/30261/CONDET	Lincoln Way Dwellings	Residential area works and associated facilities exist north of the Jocks Lodge Interchange, immediately north of substation search area in Beverley.	Submission of details required by Condition 3 (external materials), Condition 4 (landscaping), Condition 6 (boundary treatment), Condition 7 (landscape management plan), Condition 9 (tree protection), Condition 13 (drainage), Condition 15 (Ecological Construction Method Statement), Condition 17 (site specific construction environmental management plan), Condition 18 (build route), Condition 19 (Archaeological Trial Trenching Report and Written Scheme of Investigation) and Condition 20 (play area) of planning permission (15/03764/STPLF)	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Jun-17	**Screened in. Located within impact zone and potential for temporal interaction with Hornsea Four.**
40	17/30011/CONDET	Lincoln Way Dwellings	Residential area works and associated facilities exist north of the Jocks Lodge Interchange, immediately north of substation search area in Beverley.	Submission of details required by Condition 18 (Construction Compound) of planning permission 15/03764/STPLF	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Dec-15	**Screened in. Located within impact zone and potential for temporal interaction with Hornsea Four.**
41	17/02819/STVAR	Lincoln Way Dwellings	Residential area works and associated facilities exist north of the Jocks Lodge Interchange, within the SoCC boundary, with works occurring close to the north of Substation C temporary working area.	Variation of Condition 16 (working hours/delivery times) of planning permission 15/03764/STPLF to allow a change to working hours and delivery times - Erection of 100 dwellings with access to Lincoln Way, associated infrastructure and open space	East Riding of Yorkshire Council	Application withdrawn	http://www2.eastriding.gov.uk/	Jun-18	Screened out. Application withdrawn.
42	17/30611/CONDET	Lincoln Way Dwellings	Residential area works and associated facilities exist north of the Jocks Lodge Interchange, within the SoCC boundary, with works occurring close to the north of Substation C temporary working area.	Submission of details required by Condition 16 (delivery times) and Condition 17 (Construction Environmental Management Plan) of planning permission 15/03764/STPLF	East Riding of Yorkshire Council	Approved	http://www2.eastriding.gov.uk/	Nov-15	**Screened in. Located within impact zone and potential for temporal interaction with Hornsea Four.**
43		Westermost Rough	Located 8km from shore. Cable landfall point north of Tunstall and grid connection point at Salt End.	210 MW wind farm		Fully Commissioned - Round 2	https://www.4coffshore.com/offshorewind/		Screened out. Part of baseline
44		Humber Gateway	Located 10km from shore. Cable landfall point at Easington and grid connection point at Hedon.	219 MW wind farm		Fully Commissioned - Round 2	https://www.4coffshore.com/offshorewind/		Screened out. Part of baseline
45		Hornsea Project One	Windfarm located 120km from shore. The landfall is at Horsehoe Point, Marshchapel. Onshore substation is located at North Killingholme. Offshore location: Southern North Sea (Humber)	Hornsea Project 1 will contain three HVAC substations. It will contain a reactive compensation substation half way along the route due to the wind farms moving further offshore. Aggregated installed generator capacity is 1218MW.		Under Construction - Round 3	https://www.4coffshore.com/offshorewind/		Screened out. Located outwith impact zone.
46		Hornsea Project Two (Optimus and Breesea)	Windfarm located 120km from shore. The landfall is at Horsehoe Point, Marshchapel. Onshore substation is located at North Killingholme. Offshore location: Southern North Sea (Humber)	Maximum capacity stated in the development consent order for Project Two is 1800MW.		Pre- construction - Round 3	https://www.4coffshore.com/offshorewind/	Aug-16	Screened out. Located outwith impact zone.
47		Hornsea Project Three	Offshore location: Southern North Sea (Humber)	2400MW Windfarm		Consent application submitted	https://www.4coffshore.com/offshorewind/	May-18	Screened out. Located outwith impact zone.