ARVEN
OFFSHORE WIND FARM

Offshore EIA Scoping Report

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Glossary

Term	Definition
Array Area(s)	The area(s) in which wind turbine generators (WTGs) and their associated floating foundations, inter-array cables, offshore substation platforms (OSPs) and their associated bottom-fixed foundations and interconnector cables will be located.
Arven Offshore Wind Farm	A floating offshore wind farm to be developed in the areas which are the subject of Option Agreements between Crown Estate Scotland and each of Arven Offshore Wind Farm Limited (ScotWind area 19) and Arven South Limited (ScotWind area 18).
Bottom-fixed Foundations	Potential foundations that the OSPs may be installed upon, consisting of a substructure that is fixed to the seabed.
Commitment	A term used interchangeably with mitigation and enhancement measures. The purpose of Commitments is to reduce and/or eliminate Likely Significant Effect (LSE), in Environmental Impact Assessment (EIA) terms.
Cumulative Effects	The combined potential effect of the Project in combination with the potential effects from consented and future projects, on the same single receptor/resource.
Design Envelope	Project parameters that are used in the EIA for the Project. This comprises a description of the range of possible elements that make up the Project design options under consideration, as set out in detail in the project description when the exact and final engineering parameters are not yet known. This is often referred to as a "Rochdale Envelope" approach.
Developer	Arven Offshore Wind Farm Limited and Arven South Limited.
Dynamic Inter-array Cable	Sections or complete lengths of the Inter-array Cables used to link the WTGs to each other and the OSPs that are required to be flexible or dynamic in nature. Dynamic cables in floating installations are engineered to withstand the constant motion and potential stress caused by the movement of the floating structure.
Effect	Term used to express the consequences of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
EIA Directive	European Union Directive 85/337/EEC, as amended by Directive 97/11/EC, 2003/35/EC and 2009/31/EC and then codified by Directive 2011/92/EU of 13 December 2011 (as amended in 2014 by Directive 2014/52/EU).
EIA Regulations	The collective term used to refer to the following:

Term	Definition
	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; The Marine Works (Environmental Impact Assessment) Regulations 2007; and The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.
Embedded Mitigation Measures	Primary (design) and tertiary (inherent) mitigation measures that are included in the design of the Project.
Enabling Works	Offshore or onshore activities undertaken prior to formal commencement of construction, which may include (but are not limited to) archaeological investigations, environmental and engineering surveys, diversion and laying of services, and highway alterations.
Environmental Impact Assessment (EIA)	A statutory process whereby planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements on the EIA Directive and EIA Regulations, including the publication of an EIA Report (EIAR).
Floating Foundations	The foundations that the WTGs will be installed upon, consisting of a floating platform with associated mooring and anchoring systems.
Foundations	The foundation and substructure or platform on which the WTGs or OSPs are installed. Within this Scoping Report, reference is made to both Floating Foundations and Bottom-fixed Foundations.
Habitats Regulations Appraisal (HRA)	A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI).
High Voltage Alternating Current (HVAC)	High Voltage Alternating Current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
High Voltage Direct Current (HVDC)	High Voltage Direct Current is the bulk transmission of electricity by direct current (DC), whereby the flow of electric charge is in one direction.
Horizontal Directional Drilling (HDD)	A method of underground cable installation where the cable is drilled beneath a feature without the need for trenching.
Inter-array Cables	Cables which link the WTGs to each other and to the OSPs.

Term	Definition
Interconnector Cables	Cables which link OSPs to one another.
Intertidal Area	The area located between Mean Low Water Spring (MLWS) and Mean High Water Spring (MHWS).
Joint Bay	An excavation located at regular intervals along the onshore cable route consisting of a concrete flat base slab constructed beneath the ground to facilitate the jointing together of the cables.
Landfall	The area where the offshore export cables will be brought ashore.
Marine Directorate – Licensing Operations Team (MD-LOT)	The division of Marine Directorate responsible for the regulation of Marine Licence applications within the Scottish inshore region (between 0 and 12 nm) under the Marine (Scotland) Act 2010 and in the Scottish offshore region (between 12 and 200 nm) under the Marine and Coastal Access Act 2009.
Marine Directorate – Science, Evidence, Data and Digital (MD-SEDD),	The scientific division of Marine Directorate, responsible for provision of expert scientific, economic and technical advice and services on issues relating to fisheries, aquaculture, marine renewable energy. MD-SEDD provides the evidence to support the policies and regulatory activities of the Scottish Government through a programme of monitoring and research as well as performing regulatory and enforcement activities.
Marine Directorate (MD)	The directorate responsible for the integrated management of Scottish waters. Acts on behalf of the Scottish Ministers,
Marine Licence	Licence granted under the Marine (Scotland) Act 2010 and also under the Marine and Coastal Access Act 2009 if relevant.
Maximum Design Scenario	The maximum design parameters taken from the Design Envelope considered to be a worst case for any given assessment in EIA.
Mean High Water Spring (MHWS)	The average height of the high waters of spring tides above Chart Datum.
Mean Low Water Spring (MLWS)	The average height of the low waters of spring tides above Chart Datum.
Non-statutory Consultee	Organisations that the Planning Authority and/ or Marine Directorate may choose to engage (if, for example, there are planning policy reasons to do so) who are not designated in law but are likely to have an interest in a proposed development.
Offshore Development Area	The area within which the Offshore Proposed Development will be located.
Offshore EIA	The EIA relating to the Offshore Proposed Development.
Offshore EIAR	The EIAR for the Offshore Proposed Development.

Term	Definition
Offshore Export Cable Corridor (OfECC)	The area within which the Offshore Export Cables are planned to be installed.
Offshore Export Cables	The subsea electricity cables running from the OSPs to the Landfall and transmitting the electricity generated from the offshore wind farm to the onshore cable circuits for transmission onwards to the Onshore Converter Station or Onshore Substation.
Offshore Generation Infrastructure	The proposed generation infrastructure comprising WTGs and associated Floating Foundations, and the Inter-array Cables and Interconnector Cables (noting that the Interconnector Cables may be considered as either a generation or transmission asset).
Offshore Proposed Development	Arven Offshore Wind Farm and Arven South Offshore Wind Farm project elements to which the Offshore Scoping Report and Environmental Impact Assessment Report relates, inclusive of the Offshore Transmission Infrastructure and Offshore Generation Infrastructure.
Offshore Scoping Opinion	The scoping opinion that will be provided by Marine Directorate Licencing Operations Team (MD-LOT) under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017, setting out the Scottish Ministers' opinion on the content of the Offshore EIA Report (EIAR) including those issues that will or will not need to be addressed in the Offshore EIA.
Offshore Scoping Report	The scoping report setting out the proposed contents of the Offshore EIAR which is provided to MD-LOT to support the request for a scoping opinion.
Offshore Substation Platform (OSP)	The offshore platform that facilitates the transfer of power from the WTGs and Inter-array Cables to the Offshore Export Cables. For a High Voltage Direct Current (HVDC) connection the offshore platform would house a converter station to convert High Voltage Alternating Current (HVAC) to HVDC.
Offshore Transmission Infrastructure	The offshore transmission infrastructure located below MHWS, comprising OSPs and associated foundations, and the Offshore Export Cables and Interconnector Cables (noting that the Interconnector Cables may be considered as either a generation or transmission asset).
Onshore Converter Station	Converter substation located onshore to convert High Voltage Direct Current (HVDC) to High Voltage Alternating Current (HVAC) prior to connection to the SSENT Substation.
Onshore Development Area	The area within which the Onshore Proposed Development will be located.

Term	Definition
Onshore EIA	The EIA relating to the Onshore Proposed Development.
Onshore EIAR	The EIAR for the Onshore Proposed Development.
Onshore Export Cable Corridor (OnECC)	The area within which the Onshore Export Cables are planned to be installed.
Onshore Export Cables	The high voltage buried cable circuits used for the transmission of electricity between the Offshore Export Cables at Landfall to the Onshore Converter Station or Onshore Substation.
Onshore Grid Connection Cable Corridor	The area within which the Onshore Grid Connection Cables are planned to be installed.
Onshore Grid Connection Cables	The high voltage cable circuits used for the transmission of electricity between the Onshore Substation or Onshore Converter Station and the interface point with the Transmission Owner.
Onshore Proposed Development	Arven Offshore Wind Farm and Arven South Offshore Wind Farm project elements to which the Onshore Scoping Report and Environmental Impact Assessment Report relates, inclusive of the Onshore Transmission Infrastructure.
Onshore Scoping Opinion	The scoping opinion that will be provided by the relevant Local Authority under the Town and Country Planning (Scotland) Act 1997 and the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, setting out the Authority's opinion on the content of the Onshore EIA Report (Onshore EIAR) including those issues that will or will not need to be addressed in the Onshore EIA.
Onshore Scoping Report	The scoping report setting out the proposed contents of the Onshore EIAR and provided to the relevant Local Authority to support the request for a scoping opinion.
Onshore Substation	The electricity infrastructure for facilitating power transfer, control, compliance and/or voltage transformation prior to connection to the SSENT Substation.
Onshore Transmission Infrastructure	The onshore transmission infrastructure located above MLWS, comprising a short length of Offshore Export Cables, Transition Joint Bay, Onshore Export Cables, Onshore Converter Station / Onshore Substation and Onshore Grid Connection Cables.
Option Agreement	The agreement related to an area of seabed that the developer has been awarded through the ScotWind leasing process which has associated terms on which Crown Estate Scotland will grant a lease in the event that the developer succeeds in obtaining all the necessary consents and permissions.

Term	Definition
Plan Option	A location identified in the Sectoral Marine Plan as a preferred area for commercial-scale offshore wind development.
Planning Authority	The primary responsibility for the delivery of the planning service in Scotland lies with the 32 local authorities and the two national park authorities. Shetland Islands Council is the Planning Authority for the entirety of the onshore project footprint.
Potential Significant Effect	An effect should be considered potentially significant if it cannot be excluded, without mitigation, from having a negative impact on a habitat, species or other environmental aspect.
Pre-application Consultation	The offshore statutory pre-application consultation process as required under The Marine Licensing (Pre-application Consultation)(Scotland) Regulations 2013.
Primary Commitment	Measures that form an intrinsic part of the design that are described in the design evolution narrative and included within the project description.
Project	Arven Offshore Wind Farm and Arven South Offshore Wind Farm, collectively referred to as Arven. Comprising the Offshore Proposed Development and Onshore Proposed Development.
Scottish Ministers	The Ministers of the devolved Scottish Government, who exercise statutory functions transferred from the UK Government. The Scottish Ministers support the First Minister in leading the Scottish Government.
Scour Protection	Protective material positioned around offshore infrastructure (for example, anchors and foundations) on the seabed to avoid sediment being eroded as a result of the flow of water.
Secondary Commitment	Measures that require further activity in order to achieve the anticipated outcome, e.g. development of the optimum reinstatement measures for restoring a disturbed sensitive habitat.
Section 36 Consent	Consent under Section 36 of the Electricity Act 1989 for the construction, or extension, and operation of electricity generating stations.
Sectoral Marine Plan	The Sectoral Marine Plan for Offshore Wind Energy, published by the Scottish Government in 2020.
SSENT Substation	The interface point for the Project grid connection to the Transmission Owner network.
Static Inter-array Cable	Cables which link the WTGs to each other and the OSPs that are static in nature and designed to be installed in an arrangement that avoids any continuous or repeated movements.
Statutory Consultee	Organisations that are required to be consulted by the Planning Authority and/or Marine Directorate, and who have a duty to respond to

Term	Definition
	the consultation within a set deadline. Not all consultees will be statutory consultees (see non-statutory consultees definition).
Subsea Substation	Electricity transmission infrastructure located on the seabed for the collection of power from the WTGs and Inter Array Cables that facilitates connection to the Offshore Export Cables.
Tertiary Commitment	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.
Transition Joint Bay	An underground structure at the Landfall and above MHWS which accommodates the jointing of the Offshore Export Cables and the Onshore Export Cables.
Transmission Owner	The incumbent owner of the local high voltage transmission network. In this case, Scottish and Southern Electricity Networks Transmission (SSENT).
Wind Turbine Generator	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment.

List of Acronyms

Acronym / Abbreviation	Term
AA	Appropriate Assessment
AD	Air Defence
AEZ	Archaeological Exclusion Zone
AIP	Aeronautical Information Publication
AIS	Automatic Identification System
AL	Action Level
AL1	Action level 1
AL2	Action Level 2
AMAA Act 1979	Ancient Monuments and Archaeological Areas Act 1979
AMSL	Above Mean Sea Level
ANO	Air Navigation Order
ATC	Air Traffic Control
ATS	Air Traffic Services
AWB	Artificial Waterbody
BAA	British Aviation Authority
BAP	Biodiversity Action Plan

Acronym / Abbreviation	Term
BERR	Business, Enterprise and Regulatory Reform
BGS	British Geological Survey
BoCC	Birds of Conservation Concern
BODC	British Oceanographic Data Centre
BSI	British Standards Institute
BWD	Bathing Water Directive
CA	Competent Authority
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CaP	Cable Plan
CCA	Coastal Character Area
CCC	Climate Change Committee
CCR	Climate Change Resilience
CCS	Carbon Capture and Storage
CCT	Coastal Character Type
CD	Chart Datum
CEF	Cumulative Effects Framework
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CES	Crown Estate Scotland
CGNS	Celtic and Greater North Sea
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute for Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists
CMS	Construction Method Statement
COLREGs	International Regulations for Preventing Collisions at Sea
CoP	Construction Programme
COP21	Paris climate conference
CPA	Coast Protection Act
CREW	Centre of Expertise for Waters
CSEMP	Clean Seas Environmental Monitoring Program
cUXO	confirmed UXO
DAS	Digital Aerial Survey
DDV	Drop Down Video
DEA	Drag Embedment Anchor
DECC	Department of Energy and Climate Change
DGO	Defence Geographic Centre
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges

Acronym / Abbreviation	Term
DP	Decommissioning Programme
DPO	Draft Plan Option
DSLP	Development Specification and Layout Plan
DTI	Department of Trade and Industry
DTM	Digital Terrain Model
DWT	Dead Weight Tonnage
ECC	Export Cable Corridor
ECOPredS	Ecological Consequences of Orca Predation on Seals
ECoW	Environmental Clerk of Works
eDNA	Environmental DNA
EDPR	EDP Renewables
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EMSA	European Maritime Safety Agency
EPS	European Protected Species
EQS	Environmental Quality Standards
ERCoP	Emergency Response and Cooperation Plan
ES	Environmental Statement
ESCA	European Subsea Cable Association
ETRS	European Terrestrial Reference System
EU	European Union
FAD	Fish Assemblage Device
FEPA	Food and Environment Protection Act
FIR	Flight Information Region
FL	Flight Level
FLO	Fisheries Liaison Officer
FLOWW	Fisheries Liaison with Offshore Wind and Wet Renewables group
FMMS	Fisheries Management and Mitigation Strategy
FPSO	Floating Production Storage and Offloading
FSA	Formal Safety Assessment
FVCOM	Finite Volume Community Ocean Model
GBP	Great British Pound
GCS	Good Chemical Status
GDLs	Gardens and Designed Landscapes

Acronym / Abbreviation	Term
GEP	Good Ecological Potential
GES	Good Ecological Status
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GLVIA3	Guidelines for Landscape and Visual Impact Assessment Version 3
GT	Gross Tonnage
GVA	Gross Value Added
GW	Gigawatt
HAT	Highest Astronomical Tide
HCA	Helideck Certification Association
HDD	Horizontal Directional Drilling
HEPS	Historic Environment Policy Statement for Scotland
HER	Historic Environment Record
HES	Historic Environment Scotland
HIAL	Highlands and Islands Airport Limited
HMC	His Majesty's Coastguard
hMPA	Historic Marine Protected Area
HMRI	Helicopter Main Routing Indicator
HMS	His or Her Majesty's Ship
HMWB	Heavily Modified Waterbody
HND	Holistic Network Design
HNDFUE	Holistic Network Design Follow Up Exercise
HRA	Habitats Regulation Appraisal
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAC	Inter-Array Cable
IALA	International Association of Lighthouse Authorities
IAMMWG	Inter-Agency Marine Mammal Working Group
ICCI	In combination climate change impacts
ICES	International Council for the Exploration of the Seas
ICPC	International Cable Protection Committee
IEMA	Institute of Environmental Management and Assessment
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IMMA	Important Marine Mammal Area
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
INTOG	Innovation and Targeted Oil and Gas

Acronym / Abbreviation	Term
IOF	Important Ornithological Feature
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JNCC	Joint Nature Conservation Committee
JRC	Joint Radio Company
JV	Joint Venture
km	kilometres
LAT	Lowest Astronomical Tide
LCT	Landscape Character Type
LDP	Local Development Plan
LiDAR	Light Detection and Ranging
LLA	Local Landscape Area
LMP	Lighting and Marking Plan
LSE	Likely Significant Effect
LVIA	Landscape and Visual Impact Assessment
m	Metre
MAIB	Marine Investigation Accident Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MCAA	Marine Coastal Access Act
MD	Marine Directorate
MD-LOT	Marine Directorate – Licensing Operations Team
MD-SEDD	Marine Directorate - Science, Evidence, Digital and Data
MEDIN	Marine Environmental Data and Information Network
MGN	Marine Guidance Note
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
MMFR	Mean-maximum Foraging Range
MMMoP	Marine Mammal Monitoring Plan
MMO	Marine Management Organisation
MoD	Ministry of Defence
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
MRP	Mainstream Renewable Power
MSA 1995	Merchant Shipping Act 1995
MSP	Member of Scottish Parliament
MSS	Marine Scotland Science

Acronym / Abbreviation	Term
MU	Management Unit
MW	Megawatt
MW&SQ	Marine Water and Sediment Quality
NATS	National Air Traffic Services
NCCT	National Coastal Character Types
NCMPA	Nature Conservation Marine Protected Area
NCR	National Cycle Route
NERL	NATS En-Route Navigation Plc
NETS	National Electricity Transmission System
NGESO	National Grid Electricity System Operator
NGR	National Grid Reference
NLB	Northern Lighthouse Board
nm	Nautical mile
NMP	National Marine Plan
NMP2	National Marine Plan 2
NMPi	National Marine Plan interactive
NNS	Northern North Sea
NODB	National Oceanographic Data Base
NPF4	National Planning Framework 4
NRA	Navigational Risk Assessment
NS	North Sea
NSA	National Scenic Area
NSIBTS	North Sea International Benthic Trawl Survey
NSP	Navigational Safety Plan
NSTA	North Sea Transitional Authority
NTSLF	National Tide and Sea Level Facility
O&M	Operation and Maintenance
OA	Option Agreement
OfECC	Offshore Export Cable Corridor
Ofgem	Office of Gas and Electricity Markets
OMP	Operation and Maintenance Programme
OMUI	Other Marine Users and Infrastructure
ONS	Office for National Statistics
OPERA	Operational Programme for the Exchange of Weather Radar Information
OREI	Offshore Renewable Energy Installations
OS	Ordnance Survey
OSP	Offshore Substation Platform
OSPAR	Oslo Paris Convention

Acronym / Abbreviation	Term
OTNR	Offshore Transmission Network Review
OW	Ocean Winds
OWEPS	Scottish Offshore Wind Policy Statement
OWF	Offshore Wind Farm
OWIC	Offshore Wind Industry Council
PAC	Pre-Application Consultation
PAD	Protocol for Archaeological Discoveries
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PAS	Publicly Available Specification
PCB	Polychlorinated Biphenyls
PE	Population Equivalent
PEMP	Project Environmental Monitoring Programme
PEXA	Practice and Exercise Area
PINS	Planning Inspectorate
PMF	Priority Marine Feature
PMRA 1986	Protection of Military Remains Act 1986
PO	Plan Option
PrePARED	Predators and Prey Around Renewable Energy Developments
PS	Piling Strategy
PSA	Particle Size Analysis
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
Radar	Radio Detection and Ranging
RAF	Royal Air Force
RBMP	River Basin Management Plan
rBWD	Revised Bathing Water Directive
RCP	Representative Concentration Pathway
REZ	Renewable Energy Zone
RIAA	Report to Inform Appropriate Assessment
RIFG	Regional Inshore Fisheries Group
RLG	Regional Locational Guidance
RLoS	Radar Line of Sight
RMP	Regional Marine Plan
RNLI	Royal National Lifeboat Institution
RoPax	Roll-On/Roll-Off Passenger
RoRo	Roll-On/Roll-Off Cargo

Acronym / Abbreviation	Term
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAR	Search and Rescue
SCANS	Small Cetaceans in European Atlantic Waters and the North Sea
SCCA	The Shetland Coastal Character Assessment
SCCAP	Scottish Climate Change Adaptation Programme
SCDS	Supply Chain Development Statement Outlook
SCOS	Special Committee on Seals
ScotMER	Scottish Marine Energy Research
SD	Standard Deviation
SEA	Strategic Environmental Assessment
SEIA	Socioeconomic Impact Assessment
SEL_{cum}	Sound Exposure Level cumulative
SEPA	Scottish Environment Protection Agency
SFA	Shetland Fishermen's Association
SFF	Scottish Fishermen's Federation
SIC	Shetland Islands Council
SIFS	Shetland Inshore Fish Survey
SIMSP	Shetland Islands' Marine Spatial Plan
SIRMP	Shetland Islands Regional Marine Plan
SLVIA	Seascape, Landscape and Visual Impact Assessment
SMP	Sectoral Marine Plan
SMPP	Shetland Marine Planning Partnership
SMR	Scottish Marine Region
SMRU	Sea Mammal Research Unit
SMU	Seal Management Unit
SNCB	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plans
SOTEAG	Shetland Oil Terminal Environmental Advisory Group
SPA	Special Protection Area
SPAN	Scottish Passive Acoustic Network
SPFA	Scottish Pelagic Fishermen's Association
SPL_{peak}	Sound Pressure Level peak
SPM	Suspended Particulate Matter

Acronym / Abbreviation	Term
SSC	Suspended Sediment Concentration
SSENT	Scottish and Southern Electricity Networks Transmission
SSMO	Shetland Shellfish Management Organisation
SSR	Secondary Surveillance Radar
STECF	Scientific, Technical and Economic Committee for Fisheries
SWFPA	Scottish White Fish Producers Association
SWPA	Shellfish Water Protected Area
SWT	Scottish Wildlife Trust
TJB	Transition Joint Bay
TOPA	Technical and Operational Assessment
TTS	Temporary Threshold Shift
UHI	University of the Highlands and Islands
UK	United Kingdom
UKCP	UK Climate Projections
UKHO	United Kingdom Hydrographic Office
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UTM	Universal Transverse Mercator
UWN	Underwater Noise
UWWTR	Urban Waste Water Treatment Regulations
UXO	Unexploded Ordnance
VFR	Visual Flight Rules
VMP	Vessel Management Plan
VMS	Vessel Monitoring System
WDC	Whale and Dolphin Conservation
WETREP	West European Tanker Reporting System
WFD	Water Framework Directive
WGS	World Geodetic System
WLA	Wild Land Area
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

1 Introduction

1.1 Project Background

In response to the climate crisis, the Scottish Government has set an ambition to achieve net zero emissions by 2045. This, alongside the Scottish Government target to install offshore wind capacity of 11 gigawatts (GW) of energy by 2030, will help to provide a secure energy supply for the future while reducing Scotland's impact on the climate. Crown Estate Scotland's (CES) ScotWind leasing process released areas of seabed in 2021 that were identified as suitable for renewable energy development.

To support delivery of these targets, Arven Offshore Wind Farm Limited and Arven South Limited (together "the Developer"), both controlled equally by Ocean Winds and Mainstream Renewable Power, plan to develop an offshore wind farm (OWF) within the Northeast 1 (NE1) Plan Option (PO) in two Option Agreement (OA) areas. The two OA areas, also referred to as Array Areas, form part of the Offshore Proposed Development which is collectively referred to as 'Arven'. The Array Areas occupy a seabed area of 460 km^2 and are situated approximately 30 km from the Shetland Mainland and 23 km from the Shetland Islands at their nearest point (Noss). The Offshore Proposed Development will comprise of offshore Wind Turbine Generators (WTGs) and associated Floating Foundations, with the possibility of Bottom-fixed Foundations to support Offshore Substation Platforms (OSPs) and associated subsea cabling.

The Developer is currently exploring multiple routes to market for the power offtake from Arven. It is expected that a connection to the national electricity transmission system (NETS) will be made for some or all of the capacity with the potential for alternative offtake options such as direct to hydrogen production. Further detailed information on the Offshore Proposed Development is provided in Chapter 3: Description of the Offshore Proposed Development. The Offshore Proposed Development and the Onshore Proposed Development together comprise the Project.

The Developer will apply for the relevant consents and permissions that will be required from the regulatory authorities to build and operate the Project. Applications require the completion of an Environmental Impact Assessment (EIA) and the submission of an EIA Report (EIAR) to support consent applications. Scoping refers to an initial stage of the EIA process whereby the scope of the EIA and associated EIAR are agreed. This Offshore Scoping Report, which sets out the proposed scope of the EIA for the Offshore Proposed Development, has been prepared for submission to the Marine Directorate Licensing Operations Team (MD-LOT) while a separate Onshore Scoping Report relevant to the Onshore Proposed Development will be submitted to the relevant Local Authority. These will be accompanied by Habitats Regulations Appraisal (HRA) Screening Reports (covering offshore and onshore receptors as appropriate) to consider whether the Project will have likely significant effects on European sites protected under the Conservation (Natural Habitats &c.) Regulations 1994, the Conservation of Habitats and Species Regulations 2017, and the Conservation of Offshore Marine Habitats and Species Regulations 2017.

The offshore and onshore consenting processes are being progressed separately, with an offshore consents application, supported by an offshore EIAR, to be made to MD-LOT and a separate onshore planning application, supported by an onshore EIAR, to be made to the relevant Local Authority. Where there is overlap between jurisdiction of the two regimes, for example the intertidal area located between Mean High Water

Spring (MHWS) and Mean Low Water Spring (MLWS), this will be considered within both the offshore and onshore consent / planning applications and within both the Onshore Scoping Report / EIAR and the Offshore Scoping Report / EIAR and associated HRA reporting.

To reiterate, this Offshore Scoping Report takes into consideration all the offshore infrastructure elements of the Project seaward of MHWS which will be located within the offshore scoping boundaries (i.e. Array Areas and Offshore Export Cable Corridor Area of Search) shown in Figure 1.1. This Offshore Scoping Report sets out the existing baseline characterisation of the relevant offshore area and then identifies and considers all potential impacts to key sensitive receptors from the activities associated with the Offshore Proposed Development.

The Onshore Scoping Report will consider all of the onshore infrastructure associated with the Project that continues landward from MLWS (Onshore Proposed Development).

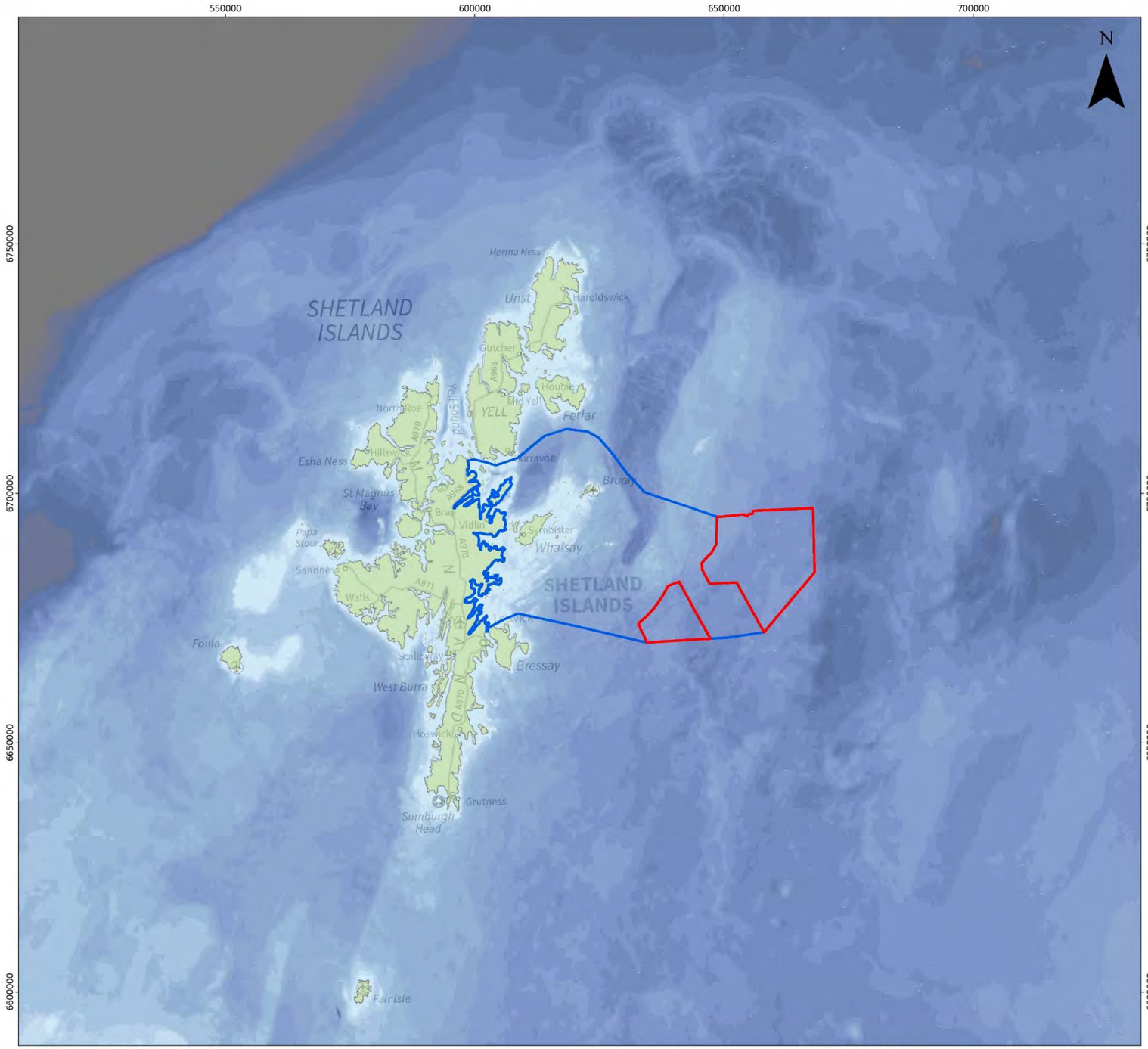


Figure Reference: AVN_0200_Fig1_SiteLocation_v3

ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

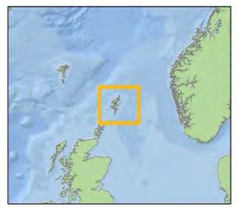
The Offshore Proposed Development

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search

Depth (m)

- 0 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 110
- 110 - 120
- 120 - 130
- 130 - 140
- 140 - 150
- 150 - 160
- 160 - 170
- 170 - 180
- 180 - 190
- 190 - 200
- >200



Notes

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Coordinate System:
WGS 1984 UTM Zone 30N

0 25 50 km

0 10 20 nm

Scale	Date	Drawn by	Checked by	Approved by
1:750,000 @A3	01/03/2024	BPHB	CM	GB

Octagon Point,
5 Cheapside,
London,
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GoBe
APEM Group

Figure 1.1

Figure 1.1: The Offshore Proposed Development Location

1.2 Purpose of this Offshore Scoping Report

The Scottish Ministers are the regulatory authority in respect of the necessary offshore consents and licences required for the construction and operation stages of an OWF project. Within the Scottish Government, this regulatory role falls to MD-LOT. This Scoping Report has been prepared to demonstrate compliance with relevant Scottish legislation (Chapter 2: Legislation and Policy Context) and provides adequate understanding of the material considerations associated with the Offshore Proposed Development.

This Offshore Scoping Report has been produced in support of a request to the Scottish Ministers (MD-LOT) for a formal Scoping Opinion under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, the Marine Works (Environmental Impact Assessment) Regulations 2007 (the 'MW Regs 2007') and the Marine Works (Environmental Impact Assessment) Regulations (Scotland) 2017 (the 'MW Regs 2017'). To aid the formulation of a Scoping Opinion, this Offshore Scoping Report establishes an understanding of the existing baseline conditions related to the Offshore Proposed Development, considers the likely significant effects that may arise on the marine and intertidal (biological) environments and other relevant physical / socioeconomic receptors and sets out those receptors considered to have potential significant effects (scoped in for assessment within the EIAR) and those considered to not have any likely significant effects (scoped out from further assessment within the EIAR).

The information received within the formal Scoping Opinion from MD-LOT will inform the next stages of the EIA process and the content of the Offshore EIAR.

This Offshore Scoping Report seeks to identify the environmental and social considerations relevant to the Offshore Proposed Development, with particular regard to the key risk factors identified within the Sectoral Marine Plan for Offshore Wind Energy (SMP) (Scottish Government, 2020a) for the North East Region including:

- Risks to bird species, including collision risk and displacement, as well as potential impacts to birds on migratory pathways;
- Potential impacts on commercial fishing;
- Potential impacts on marine mammal receptors;
- Potential impacts on migratory fish species;
- Potential impacts on benthic habitat and species; and
- Potential cost impacts and associated navigational risk from diverting key commercial shipping routes.

This Offshore Scoping Report provides information on the following aspects:

- The background, description and the need for the Project and the Offshore Proposed Development;
- Key legislation and policy that must be complied with;
- Offshore topics, receptors and potential impacts scoped into the EIA, where potentially significant effects may result from the Offshore Proposed Development on the physical, biological and human environment and how these impacts are proposed to be assessed;
- Offshore topics, receptors and potential impacts considered and proposed to be scoped out of the EIA, where significant effects are not predicted with consideration of embedded mitigation and industry best practice guidance; and

- An outline of the proposed approach and methodology of the EIA process that will be implemented to gain a full and as complete as possible understanding of the existing baseline conditions associated with the Offshore Proposed Development as well as future baseline conditions if the Offshore Proposed Development should not be progressed.

This Offshore Scoping Report is informed by publicly available information (navigation charts, georeferenced data, technical studies, geological, hydrogeological studies, archaeological studies, etc.) as well as site-specific survey data. Feedback from pre-scoping engagement in the form of scoping workshops, one-to-one meetings with stakeholders, and a public engagement event has also informed the Offshore Scoping Report.

1.3 Developer Background

The Developer is two entities; Arven Offshore Wind Farm Limited and Arven South Limited both equally controlled by Ocean Winds (OW) and Mainstream Renewable Power (MRP).

OW is an international company dedicated to offshore wind energy and created as a 50-50 joint venture, owned by EDP Renewables (EDPR) and ENGIE. Based on their belief that offshore wind energy is an essential part of the global energy transition, OW develop, finance, build and operate OWF projects all around the world. When EDPR and ENGIE combined their offshore wind assets and project pipeline to create OW in 2019, the company had a total of 1.5 GW under construction and 4.0 GW under development. OW has been adding rapidly to that portfolio and is now on a trajectory to reach the 2025 target of 5 to 7 GW of projects in operation or construction and 5 to 10 GW under advanced development. Currently, OW's offshore wind gross capacity already operating, in construction or with advanced development rights granted has reached 16.6 GW.

MRP is a leading renewable energy company, with wind and solar assets across global markets, including in Europe, Latin America, Africa, and Asia-Pacific. MRP is one of the most successful developers of gigawatt-scale renewables platforms, across onshore wind, offshore wind, and solar power generation. It has successfully delivered 6.5 GW of wind and solar generation assets to financial close-ready and has a global pipeline of 20.8 GW, with 1.1 GW in operation.

Both OW and MRP have experience in developing OWF projects in Scottish waters.

1.4 Consents

To construct and operate the Offshore Proposed Development, the Developer is required to apply for consent under Section 36 of the Electricity Act 1989 as well as for Marine Licences under the Marine (Scotland) Act 2010 (within 12 nm) and the Marine and Coastal Access Act 2009 (outwith 12 nm) and Works Licences from the Shetland Islands Council under the Zetland County Council Act 1974 (within 12nm). Additional consent requisites and processes are often necessary, including European protected species (EPS) licenses and HRA. A detailed EIA will be carried out which appropriately identifies all the sensitive receptors and potential significant effects of the Offshore Proposed Development after which consent will be sought.

The Developer will undertake the Offshore EIA in line with legislative requirements including the following Regulations:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and
- The Marine Works (Environmental Impact Assessment) Regulations 2007.

These Regulations are collectively referred to as "the EIA Regulations". The Onshore EIA will be developed separately under The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

1.5 Report Structure

The structure of this Offshore Scoping Report is set out within Table 1.1.

Table 1.1: Offshore Scoping Report Structure

Chapter	Title	Summary	Author
1	Introduction	Introduces the Offshore Proposed Development, the Developer and the key objectives and outcomes from the Offshore Scoping Report.	GoBe
2	Legislation and Policy	Provides an overview of the legislation and policy relevant to the Offshore Proposed Development.	GoBe
3	Description of Proposed Development	Provides a summary of the Offshore Proposed Development.	GoBe
4	EIA Methodology	Describes the proposed EIA methodology, including measures taken to proceed towards proportionate EIA.	GoBe
5	Consultation	Describes the approach to stakeholder consultation related to this EIA.	GoBe
6-19	Offshore technical topics – Physical Environment	Chapter 6: Marine Geology, Oceanography and Physical Processes Chapter 7: Marine Water and Sediment Quality	GoBe
	Offshore technical topics – Biological Environment	Chapter 8: Benthic and Intertidal Ecology Chapter 9: Fish and Shellfish Ecology Chapter 10: Marine Mammal Ecology Chapter 11: Offshore Ornithology	GoBe
	Offshore technical topics – Human and Socio-Economic Environment	Chapter 12: Seascape, Landscape and Visual Impact Assessment (SLVIA)	OPEN
		Chapter 13: Commercial Fisheries	NiMa
		Chapter 14: Aviation and Radar	Cyrrus
		Chapter 15: Shipping and Navigation	Anatec

Chapter	Title	Summary	Author
		Chapter 16: Offshore Archaeology and Cultural Heritage	Wessex Archaeology
		Chapter 17: Other Marine Users and Infrastructure (	GoBe
		Chapter 18: Socioeconomics, Tourism and Recreation	BiGGAR Economics
		Chapter 19: Climate Change and Greenhouse Gas	GoBe
20	Summary Chapter	Summarises the scoping approach.	GoBe
Appendix A	Commitments Register	Sets out all the specific mitigation measures that the Developer currently intends to adopt in relation to ensuring potential significant impacts are avoided, reduced or minimised.	GoBe
Appendix B	Impact Register	Captures all of the potential impacts that have been scoped in for further consideration as part of the EIA.	GoBe

2 Legislation and Policy Context

2.1 Introduction

This chapter describes the key legislation and policy relevant to the Offshore Proposed Development.

2.2 Policy Context

2.2.1 Climate Change and Renewable Energy

Climate change challenges have been one of the main drivers for policy and legislative change in recent years in order to work towards decarbonisation and the promotion of renewable energy generation. These challenges are shaping international policies and national policies, strategies and regulations in the UK and Scotland. In Scotland, the Climate Change (Scotland) Act 2009, amended by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (Scottish Government, 2009; 2019a), sets out the national long-term climate change targets in response to the climate emergency. This includes the reduction of all greenhouse gas (GHG) emissions to net zero by 2045 (ahead of many other countries' net-zero targets); with interim targets of 75% reduction by 2030 and 90% by 2040. These GHG emission reduction targets are set out in line with the advice received by the Climate Change Committee (CCC), a statutory body, formed under the Climate Change Act 2008. The development of renewable energy projects will be a necessary contribution to meet these net-zero targets. Offshore wind developments are at the forefront of national renewable development processes, with the 2022 CES ScotWind leasing round and further Innovation and Targeted Oil and Gas (INTOG) leasing round in 2023. The subsequent renewable energy developments that will emerge from these processes (including the Project) will contribute positively to achieving these national targets.

2.2.2 Paris Agreement

The Paris climate conference (COP21) held in 2015, established the first global climate deal; the Paris Agreement (2015). A total of 195 countries are party to the Agreement, which has the aim of decreasing the global temperature rise to well below 2°C, above pre-industrial levels and to pursue efforts to limit the global temperature increase to 1.5°C or less. These targets were set out by the United Nations (UN) Intergovernmental Panel on Climate Change (IPCC). To achieve these targets, the peak of GHG emissions must turn as soon as possible and be in decline by 2030. The development of the renewable energy sector in the UK and Scotland (including the Project) supports the aims of the Agreement and the GHG reduction targets with the decarbonisation of the energy sector.

2.2.3 Scottish Energy Strategy and British Energy Security Strategy

The first Scottish Energy Strategy: The Future of Energy in Scotland (Scottish Government 2017) is the government's 2050 vision for the energy system in Scotland in order to deliver secure, affordable, clean energy for Scotland's households, communities and businesses. The strategy aims to support works that will help to achieve Scotland's long term climate change targets. This includes the future delivery of renewable energy with a target of 50% of Scotland's energy for heat, transport and electricity consumption to be supplied from renewable sources by 2030.

The UK government published the British Energy Security Strategy (HM Government, 2022) which sets targets including the delivery of up to 50 GW of offshore wind by 2030, including up to 5 GW of floating wind. The Project will support delivery of these targets.

2.2.4 Scottish Offshore Wind Policy Statement

The Scottish Offshore Wind Policy Statement (OWEPS) (Scottish Government, 2020b) sets out the targets, ambitions and the importance of offshore wind developments in Scottish waters and includes the opportunity for up to 11GW of offshore wind. The Statement sets the course for the Government's net-zero commitments for 2045 and renewable energy delivery whilst protecting marine users and the environment. The Policy builds on the ambitions outlined within the Scottish Energy Strategy (Scottish Government, 2017), details the context for Marine Scotland's Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020a) and builds on the launch of offshore wind planning areas.

2.2.5 Draft Energy Strategy and Just Transition Plan

In January 2023 the Scottish Government published the Draft Energy Strategy and Just Transition Plan which sets out the 2045 vision that Scotland will;

> *'have a flourishing, climate friendly energy system that delivers affordable, resilient and clean energy supplies for Scotland's households, communities and business'*

To deliver on this vision, the Draft Energy Strategy and Just Transition Plan set out a roadmap of actions and policies to reach by 2030. The Draft Energy Strategy and Just Transition Plan suggests scaling up renewable energy developments including offshore wind and incorporates the updated target of 50% of heat, electricity and transport needs to be met by renewable energy in 2030 supporting the target set out in the first Scottish Energy Strategy.

The Draft Energy Strategy and Just Transition Plan aim to significantly increase renewable energy production, in order to secure a just transition away from fossil fuels. To succeed with this aim the Draft Energy Strategy proposes the delivery of an additional 20 GW of energy from renewable sources by 2030. The Project will support delivery of these targets. Consultation on the Draft Energy Strategy and Just Transition Plan closed in May 2023.

2.2.6 National Planning Framework 4

The Scottish National Planning Framework 4 (NPF4) (Scottish Government 2023b) was published in February 2023 replacing the National Planning Framework 3 (NPF3) and Scottish Planning Policy (2014) as the national spatial strategy. It sets out the spatial principles, regional priorities, national developments and the national planning policy as well as including key actions for development and infrastructure to be taken forward to 2045. NPF4 sets the measures to be taken forward in order to enable the sustainable use of natural assets during the development of infrastructure within the transition to net zero whilst managing developments sustainably. NPF4 is highly supportive of renewable energy development (such as the Project) in terms of addressing climate change, energy security and biodiversity loss.

2.2.7 Marine Planning Framework in Scotland

Marine Planning in Scottish inshore and offshore waters is governed by the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009. These Acts (hereafter the Marine Acts) have established the legislative framework for management and planning and use a tiered approach for the development of marine plans and projects in the UK and Scotland. The UK Marine Policy Statement (MPS) 2011 (HM Government, 2011) is part of the framework set out by the Marine Acts and was prepared and adopted for the purpose of Section 44 of the Marine and Coastal Access Act 2009. The MPS sets out the framework for preparing Marine Plans and contributes to the achievement of sustainable development (such as the Project) in the UK marine area.

2.2.8 National Marine Plan

The Scottish National Marine Plan (NMP) was adopted in 2015 (Scottish Government 2015a) and supported activity and development in Scotland's seas out to 200 nm. The Scottish National Marine Plan sets out the overarching framework for all marine activity in Scottish waters, enabling sustainable development and use of the marine area to protect and enhance the environment whilst supporting existing and developing industries. The Scottish National Marine Plan is required to be consistent with the MPS and the existing marine plans across the UK.

There are eight objectives detailed by the NMP for the offshore wind and renewable energy sector in Scotland:

- Sustainable development of offshore wind, wave and tidal renewable energy in the most suitable locations;
- Economic benefits from offshore wind, wave and tidal energy developments maximised by securing a competitive local supply chain in Scotland;
- Alignment of marine and terrestrial planning and efficient consenting and licensing processes including but not limited to data sharing, engagement and timings, where possible;
- Aligned marine and terrestrial electricity transmission grid planning and development in Scottish waters;
- Contribute to achieving the renewables target to generate electricity equivalent to 100% of Scotland's gross annual electricity consumption from renewable sources by 2020;
- Contribute to achieving the decarbonisation target of 50 g CO2/kWh by 2030 (to cut carbon emissions from electricity generation by more than four-fifths);
- Sustainable development and expansion of test and demonstration facilities for offshore wind and marine renewable energy devices; and
- Co-ordinated government and industry-wide monitoring.

Since its adoption in 2015, the NMP has been reviewed twice, once in 2018 and again in 2021. The 2021 review found that it was necessary to update the NMP to tackle the climate and biodiversity loss crises and to reflect the significant changes in the wider policy and legislative landscape, the rapid developments in technology, and the need to deliver a green recovery from COVID-19. As a result, National Marine Plan 2 (NMP2) is currently being produced by the Scottish Government. The Project will likely need to consider NMP2 alongside the NMP within the subsequent EIA process.

2.2.9 Sectoral Marine Plan

The first SMP for Offshore Wind Energy was developed in 2011 (Scottish Government 2011). In 2013, Marine Scotland (now the Marine Directorate (MD)) published the Draft Sectoral Marine Plan for Offshore Wind, Wave and Tidal energy in Scotland (Marine Scotland 2013), but this was never formally adopted by the Scottish Ministers. This draft 2013 SMP identified the potential future development options for offshore wind energy developments that were included in the 2015 NMP.

CES announced the intention to run a leasing round for commercial scale offshore wind projects in 2017, known as the ScotWind leasing round. In order to attain this, Marine Scotland undertook an extensive marine planning exercise and identified suitable areas for OWF developments, in accordance with relevant UK and Scottish legislation.

Following this assessment, an updated SMP for Offshore Wind Energy was published in 2020 (Scottish Government 2020a) and built upon the 2011 and 2013 plans and provided the results of the marine planning exercise, with aims to contribute to Scotland's and the UK's energy and climate change objectives. The 2020 SMP provided the spatial strategy that would support the CES ScotWind leasing round that concluded in 2022. The 2020 SMP identified 15 areas of seabed as most suitable for renewable energy POs capable of generating several GW of renewable energy. There have been 20 seabed option agreements within these POs awarded during the ScotWind leasing process as of 2023, (17 in April 2022 and 3 in October 2022) with a total of 27.6 GW of renewable energy capacity. If this is attained, a significant contribution to the 2045 net-zero target will be reached. SEA, HRA and socio-economic assessments were undertaken as part of the development of the SMP.

The 2020 SMP identified the NE1 PO as a suitable site for offshore wind development and the HRA established that the site is free from plan level constraints relating to the potential for adverse effects on the site integrity of any European site. The 2020 SMP also identified NE1 to have some potential for significant cost impacts associated with the loss of fishing grounds, as well as areas within the PO that may comprise important fish spawning grounds. The 2020 SMP notes the need for the Developer to consult with the MoD regarding potential radar interference. NE1 lies adjacent to the Pobie Bank Reef SAC and the 2020 SMP states that benthic surveys should be undertaken to identify impacts, with spatial planning potentially required for mitigation. The EIA process will take these into consideration.

The next iteration of the SMP is underway and consultation is expected to start in Q3 2024.

2.2.10 Regional Marine Plan

The Marine (Scotland) Act 2010 enables Scottish Ministers to identify boundaries for Scottish marine regions (SMR) for the purpose of regional planning. The Scottish Marine Regions Order 2015 (Scottish Government 2015b) identified and established the boundaries for 11 SMRs with Shetland being one of these marine regions. The boundaries identify the areas for preparing and adopting regional marine plans (RMPs). RMPs can be set up within SMRs when a Marine Planning Partnership has been put in place. RMPs are developed in accordance with the existing legislation in Scotland and the NMP. The RMP for the Shetland Islands, which is inclusive of waters out to 12 nautical miles and thus relevant to any Project-related infrastructure to be located inside of the 12 nautical mile limit, was initiated in 2016 and is currently in draft form awaiting approval

from the Scottish Ministers. The Shetland Islands Regional Marine Plan (SIRMP) builds upon the 4th Edition of the Shetland Islands' Marine Spatial Plan (SIMSP), with the aim of ensuring that the use of the marine and coastal environment of Shetland is sustainable by maintaining and enhancing marine wildlife, habitats and ecosystems. The Developer will consider the SIRMP in developing the Offshore Proposed Development (in particular the elements of the Project inside of the 12 nautical mile limit) and in preparing consent application documents and will follow the aims set out in the SIRMP:

- Engage with stakeholders and the wider public early in their proposal's development.
- Consider the beneficial and adverse impacts of their proposed development on the economy, society and the environment. Where adverse impacts cannot be avoided, mitigation measures and alternatives should be considered.
- Supply the relevant materials for the relevant public authorities to assess their proposals.
- Ensure any evidence that is put forward is sound and proportionate to the development proposed.
- Apply the policies set out through the SIRMP.

2.2.11 Shetland Energy Strategy and Development Principles

The draft Shetland Energy Strategy (Shetland Island Council (SIC) 2024) provides an opportunity to put in place a framework to support decision making on local energy transition projects including the Offshore Proposed Development. The Energy Strategy extends out to 2045 in line with the Net Zero target for Scotland but will be a live document to reflect the ever-changing energy landscape. The Energy Strategy's vision is that by 2045:

- There will be full access to clean, affordable and secure energy produced in Shetland;
- Energy Developers will have fully engaged with the Energy Development Principles (below) across all four themes through project development, delivery and decommissioning; and
- Shetland continues to have a skilled workforce and strong supply chain, building on the foundations which are currently in place.

The four long term outcomes of the Shetland Energy Strategy are to:

- Reduce emissions;
- Secure affordable energy;
- Create & retain local wealth; and
- Skills and capacity development.

The draft Energy Strategy has been consulted upon up to March 2024 and will now be finalised.

In December 2022, the SIC approved a set of 'Shetland Energy Development Principles'. These principles are promoted to all existing and prospective energy developers, UK and Scottish Governments, their agencies, relevant regulators and others. There are eight different principles, all of which apply to the Offshore Proposed Development, and they are focused on ensuring that offshore renewable energy is developed in an environmentally responsible manner and that it delivers benefits locally as well as nationally:

- 1.1 – Energy Developments on and around Shetland
- 1.2 - Consenting Development and Environmental Protection
- 1.3 – Realising Local Supply Chain Opportunities; Upstream, Midstream and Downstream
- 1.4 – Fair Local share of income from Land and Seabed rents and option payments
- 1.5 – Protecting the Marine Environment and existing Economic Sectors

- 1.5.1 – Marine Environment Protection
- 1.6 - Direct Community Benefit to Shetland as the Local Host
- 1.6.1 – Identification of Host Community
- 1.7 - Community Benefit Package
- 1.7.1 - Community Benefit Delivery Vehicles – Benefit Funds
- 1.7.2 - Community Benefit Delivery Vehicles – Energy Benefits
- 1.8 - Reform of Electricity Regulation and Pricing in a "Green Energy Area"

2.2.12 Shetland Local Development Plan 2014

The Local Development Plan (LDP; Shetland Islands Council, 2014) sets out SICs land use strategy up until 2034 and aims to achieve delivery of a strong economy and communities while respecting the environment and natural resources. The LDP establishes a vision and spatial strategy in relation to development and sustainable growth, which is based on a series of policies. While the LDP focuses on the development of land, it also includes policies on the coastal environment and water environment. Relevant policies that will be considered during the EIA process include:

- Natural Heritage 7: Water Environment – This policy states that development will only be permitted where appropriate measures are taken to protect the marine and freshwater environments (including tidal and coastal waters) and that potential for a development to have adverse impacts must be addressed;
- Historic Environment 1: Historic Environment – This policy covers protection, conservation and enhancement of marine heritage;
- Historic Environment 4: Archaeology – Under this policy designated wrecks and other identified nationally important archaeological resources should be preserved in situ. Developments that have an adverse effect on designated wrecks or their integrity should not be permitted.
- Coastal Development 1: Coastal Development – This policy is relevant to the coastal zone above MLWM and sets out that development proposals will only be permitted when it can be demonstrated that there will not be significant impacts (individually or cumulatively) on the natural, built environment, cultural heritage resources in the sea or on other marine users or resources. The location, scale and design of the development must not have a significant adverse impact and there will be no deterioration in ecological status. All proposals will need to be assessed against the Shetland Islands Marine Spatial Plan (Shetland Islands Council, 2015); and
- Renewable Energy 1: Renewable Energy – this policy commits the Council to delivering renewable energy developments that contribute to the sustainable development of Shetland and supports these proposals where there are no unacceptable impacts on people, the natural and water environment, landscape, historic environment and the built environment and cultural heritage.

The Shetland Islands Marine Spatial Plan forms part of the Supplementary Guidance to the Shetland Local Development Plan and provides an important framework to help balance competing demands in the coastal and marine area. It identifies the constraints developers are required to consider when contemplating development in the coastal area and provides advice on legislative requirements.

2.3 Relevant Legislative, Regulative and Licensing Context

2.3.1 Electricity Act 1989

The Developer will be required to submit an application to obtain consent from the Scottish Ministers under Section 36 (s36) of the Electricity Act 1989. S36 of the Electricity Act 1989 requires consent to be obtained for the construction and operation of a generating station. Section 36A allows the Scottish Ministers to extinguish

public rights of navigation in OWF development areas. Section 36B sets out the duties in relation to navigation. A s36 consent must be obtained before an offshore electricity generating station with a capacity exceeding 1 megawatt (MW) in Scottish inshore waters, and over 50 MW in Scottish offshore waters can be constructed or operated. The Developer will make the application for consent under s36 for the construction and operation of the Offshore Proposed Development to MD-LOT who will consider the application on behalf of the Scottish Ministers. The consent decision will be taken by the Scottish Ministers.

2.3.2 Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009 (the Marine Acts)

In addition to the consent required under s36 of the Electricity Act 1989, the Marine Acts regulate marine licensing and enforcement in Scotland's waters. The Marine Licensing provisions under Part 4 of these Acts were introduced to ensure that the policies of marine plans are adhered to and to ensure licensing and consenting mechanisms are followed. Under the Marine Acts it is an offence to carry on, or cause or permit another person to carry on, a 'licensable marine activity' without a Marine Licence. The following are licensable marine activities in Scottish waters:

- Deposit any substance or object in the sea or on or under the seabed from a vehicle, vessel, aircraft, floating container, marine structure or structure for the purpose of depositing solids in the sea;
- Construct, alter or improve works in or over the sea or on or under the seabed;
- Remove substances or objects from the seabed;
- Any form of dredging (including plough, agitation, side-casting and water injection dredging);
- Deposit and/or use explosives; and
- Incinerate substances or objects.

The Scottish Ministers grant Marine Licences under Part 4 of the Marine Acts with input and recommendations made by MD-LOT.

2.3.2.1 Marine (Scotland) Act 2010

The Marine (Scotland) Act 2010 applies to the Scottish inshore region (between 0 and 12nm from MHWS) and provides the relevant legislative and management framework for the marine environment. The Developer is required to apply for a Marine Licence for the construction and operation of the Offshore Proposed Development within 12nm under the Marine (Scotland) Act 2010.

2.3.2.2 Marine and Coastal Access Act 2009

The Marine and Coastal Access Act 2009 provides the framework for the sustainable management, marine planning and conservation in the Scottish Offshore Region beyond 12 nm. The Act was established under EU law and sets out the requirements for the UK Marine Policy Statement. The Developer is required to apply for a Marine Licence for the construction and operation of the Offshore Proposed Development beyond 12nm under the Marine and Coastal Access Act 2009.

2.3.3 Islands (Scotland) Act 2018

The Islands (Scotland) Act 2018 (Islands Act) seeks to create the right environment for sustainable growth on and around Scotland's islands. The Islands Act sets out the duty on the Scottish Ministers to prepare a National Islands Plan which incorporates 13 strategic objectives to improve outcomes for island communities. The strategic objectives relevant to the Offshore Proposed development are:

- Strategic Objective 2: To improve and promote sustainable economic development; and
- Strategic Objective 9: To contribute to climate change mitigation and adaptation and promote clean, affordable and secure energy.

The Project will support delivery of these objectives.

2.3.4 The Town and Country Planning (Scotland) Act 1997

The consent for the onshore aspects of the Project will be sought separately under the Town and Country Planning (Scotland) Act 1997 which is the basis for the Onshore Scottish Planning System with regards to development plans, management and enforcement. A separate Onshore Scoping Report will be submitted to support the EIA and associated planning application. The Town and Country Planning (Scotland) Act 1997 covers the onshore region down to MLWS and the Marine (Scotland) Act 2010 applies up to MHWS, due to this overlap in jurisdiction, the intertidal area associated with the Project will be covered by both the Offshore and Onshore Scoping Reports.

2.3.5 The Energy Act 2004 and the Energy Act 2023

The Energy Act 2004 (2004 Act) provides the legislative framework to advance the development of renewable energy developments and pipelines beyond territorial waters and to strengthen the regime for inshore waters.

Under Section 95 of the 2004 Act, where renewable energy installations are proposed to be developed, the Scottish Ministers can issue notices to declare one or more safety zones around offshore renewable energy installations (OREI) comprised within the Offshore Proposed Development. These safety zones can be declared during the main stages of life of a proposed development (construction, operation and decommissioning) to ensure safety. These zones can prohibit certain activities and vessels in the designated area for a specific period. Consequently, this may restrict vessels unrelated to the development of the OWF infrastructure from traversing, entering and / or remaining in the designated area. The Developer expects to apply for standard safety zones during construction and notable maintenance activities around the offshore structures, where necessary.

Sections 105 to 114 of the 2004 Act require OREIs in Scottish waters to prepare a Decommissioning Programme (DP) to be approved by Scottish Ministers. This Programme is required to include decommissioning standards, financial security, residual liability, and industry cooperation and collaboration.

The Energy Act 2023 (2023 Act) further updates the legislative framework with the intention of advancing the development of renewable energy developments and reducing consenting timeframes. Section 291 of the 2023 Act provides that the Scottish Ministers can take strategic compensatory measures into account where all feasible mitigation measures targeted at reducing adverse impacts on protected sites have been exhausted. Section 292 introduces the provision for the establishment, operation and management of one or more marine recovery funds. Section 293 allows the Scottish Ministers to make provision for the assessment of the environmental effects of relevant offshore wind activities in relation to protected sites (HRA).

2.3.6 Zetland County Council Act 1974

Under the Zetland County Council Act 1974, SIC has the duty to promote and uphold conservation by controlling developments in the coastal area (within 12 nm) including harbour powers for ports in Shetland,

with the exception of the areas under the jurisdiction of Lerwick Port Authority or Broonies Taing Pier Trust. This means that works associated with offshore developments of all types, other than for the purpose of marine fish farming, on the seabed or the foreshore below MHWS and out to the 12 nm limit require a Shetland Works Licence. This includes works associated with the Offshore Proposed Development as an Offshore Marine Renewable Energy Development designed to produce over 1 MW total output. The Developer is required to apply to the SIC for a Works Licence for the construction and O&M of the Offshore Proposed Development under the Zetland County Council Act 1974.

2.3.7 Harbours Act 1964

Under the Harbours Act 1964, the Offshore Proposed Development may require a Works Order, for works associated with the Offshore Proposed Development that will be carried out within statutory Harbour and Ports Limits. This may be required alongside consent from the relevant Port or Harbour Authorities. A Works Order confirms that all the necessary consultation has been carried out and that no adverse effects on the safety of navigation have been declared within the Harbour or Port area. A Works Order may be required depending on the location of the landfall and Offshore Export Cable Corridor (OfECC) route. The Works Order may be required from either the Lerwick Port Authority or the SIC (which is the Port authority for all ports on the Shetland islands other than Lerwick Port, as mentioned in Section 2.3.6).

2.3.8 Pre-application Consultation Regulations

The Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013, known as the PAC Regulations and Sections 22 to 24 of the Marine (Scotland) Act 2010 declare that certain activities are subject to a Pre-application Consultation (PAC) procedure. This includes activities that have the potential for significant impacts upon the environment, local communities, and other sea users. The PAC Regulations apply to activities that occur within the Scottish Inshore Region. Whilst the Regulations do not apply to activities and applications within the Scottish Offshore Region, the Developer will follow the principles of the PAC Regulations for all aspects of the Offshore Proposed Development.

The PAC process involves undertaking public consultation prior to submission of certain Marine Licence applications (Scottish Government, 2020c). During this process developers for offshore renewable energy projects must:

- Hold one or more public pre-application consultation events for interested parties to consider and comment on the Offshore Proposed Development;
- Notify the Maritime and Coastguard Agency (MCA), the Northern Lighthouse Board (NLB), NatureScot and the Scottish Environment Protection Agency (SEPA) along with any delegate for the relevant marine region (if established under Section 12(1) of the Marine (Scotland) Act 2010) that an application for a marine licence will be submitted to MD-LOT and notify them of the PAC event;
- Post a notice of the event in a local newspaper including the description and location of the marine licensable activity, and the details of the PAC event, and how to submit comments to the developer and within which timeframe; and
- Prepare and submit a PAC report to MD-LOT alongside the Marine Licence application.

Whilst the Array Areas are located in Scottish offshore waters (12 nm to 200 nm), the PAC Regulations are considered good practice for undertaking public engagement and will be followed.

2.4 Legislation Relevant to Nature Conservation

2.4.1 Habitat Regulations

The EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC), is commonly referred to as the 'Habitats Directive' and requires the establishment of a network of designated European sites known as SACs that contribute to the protection of habitats and species classified within Annexes I and II of the Directive. The EU Directive on the Conservation of Wild Birds (2009/147/EC) is commonly known as the 'Birds Directive' and established strictly protected sites known as Special Protection Areas (SPAs) for rare and vulnerable birds (Annex I) and migratory species.

These Directives have been transposed into Scottish Law within the Conservation (Natural Habitats, &c.) Regulations 1994 (up to 12 nm), the Conservation of Habitats and Species Regulations 2017 (of relevance to consents under Section 36 of the Electricity act 1989), the Conservation of Offshore Marine Habitats and Species Regulations 2017 (beyond 12 nm), and the Wildlife and Countryside Act 1981.

Following Brexit, the Habitats Directive (92/43/EEC) was transposed into UK law in December 2020 and the Scottish Parliament passed The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019 to transfer the functions from the European Commission to the Competent Authorities (CAs) in Scotland to ensure that Scotland's nature remains protected to at least the same environmental standards as the EU. As the UK is no longer part of the EU's Natura 2000 ecological network the Conservation (Natural Habitats &c.) Regulations 1994, the Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (together referred to as "the Habitats Regulations") were amended to create the UK's National Site Network on land and at sea, including both inshore and offshore marine areas, to replace the Natura 2000 network. This UK National Site Network includes all SACs and SPAs formerly part of the EU Natura 2000 ecological network, and new SACs and SPAs designated under the Habitats Regulations, as well as candidate SACs (cSACs), proposed SPAs and Ramsar sites. The protection levels and standards that have been provided to these sites are unchanged from the European Directives and the terms "European site", "European marine site" and "European offshore marine site" have been retained.

Scottish policy (Policy 4 of the NPF4) (Scottish Government 2023b) notes that all Ramsar sites (wetlands of international importance) in Scotland are also SACs and/or SPAs or sites of scientific special interest (SSSIs) and are protected under the Habitats Regulations. Ramsar sites were designated under the Ramsar convention on Wetlands of International Importance (1971) which was ratified by the UK in 1976.

The Habitats Regulations require that wherever a plan, project or activity, that is not directly connected to, or necessary to the management of a European/Ramsar site, is to have a likely significant effect (LSE) on a European/Ramsar site (directly, indirectly, alone or in-combination with other plans, projects or activities), then an Appropriate Assessment (AA) of the implications for that site in view of that site's Conservation Objectives must be undertaken by the CA. The HRA process, comprising Stage 1 (HRA Screening) and, if required, Stage 2 (AA), must be carried out before consent or authorisation can be given for the proposed development.

In accordance with the Habitats Regulations, an Offshore HRA Screening Report is being prepared for the Offshore Proposed Development and HRA reporting requirements will be progressed alongside the EIA. The HRA Offshore Screening Report has been submitted to MD-LOT at the same time as this Offshore Scoping Report.

2.4.1.1 European Protected Species

EPS are animals and plants listed in Annex IV of the Habitats Directive, and therefore, are now protected under Habitats Regulations. Under these Regulations, activities that may cause disturbance or injury to EPS which would otherwise constitute an offence, can be carried out legally under an EPS Licence (Scottish Government 2023c). For example, activities such as subsea noise disturbance caused by piling activities during construction can be licensed under EPS licences.

The reason for an EPS licence application must relate to one of the purposes specified in the Habitats Regulations. For example, regulation 44(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 provides that one such purpose is for "*...imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment*". Licences are only granted if there is no satisfactory alternative to the activity proposed. Mitigation and compensation measures proposed to minimise the impacts on EPS must be included in the licence.

NatureScot is the responsible licensing authority for most EPS licences in Scotland relating to scientific research or conservation. For renewable energy development activities including geophysical surveys and installation of renewable energy devices which are likely to cause disturbance or injury to a marine EPS, MD-LOT is the licensing authority (on behalf of the Scottish Ministers).

The Developer will submit applications for EPS Licences where appropriate. Should additional licences be required across the lifecycle of the Offshore Proposed Development, these will be discussed and agreed with the relevant licensing authority.

2.4.1.2 Priority Marine Features

In 2014 Scottish Natural Heritage (now NatureScot), the Joint Nature Conservation Committee (JNCC) and the MD identified 81 species and habitats in the seas around Scotland as Priority Marine Features (PMFs), and these were then adopted by the Scottish Ministers. The list was established through consultation with a range of specialists and the public and is used to deliver the MD's vision for marine nature conservation set out in relevant Scottish policy. The policy requirements to conserve PMFs are established through:

- The Scottish Government Strategy for Marine Nature Conservation (Scottish Government 2023d);
- The Scottish Biodiversity Strategy 2020 Challenge (Scottish Government 2013a);
- The Draft Scottish Biodiversity Strategy to 2045, Tackling the Nature Emergency in Scotland (Scottish Government, 2022); and
- Scotland's National Marine Plan (GEN 9 Natural Heritage) (Scottish Government, 2015a); and Draft Scottish Biodiversity Strategy to 2045 (Scottish Government 2022b).

PMFs include features characteristic of the Scottish marine environment, present within territorial waters or offshore waters only as well as species present in both and cover a range of intertidal, deep and continental

habitats from flame shell beds to cold-water coral reefs and various species of mammals, fish, shellfish and other invertebrates including minke whales and basking sharks.

NatureScot established the PMF checklist which sets out questions that guide the assessment of a proposed development's potential for impact on PMFs. The Developer will submit a PMF checklist for the Offshore Proposed Development in view of the PMFs present in the Array Areas and the OfECC to describe the risk of impacts, the scale and the consideration of cumulative impacts for review and advice from NatureScot.

2.4.1.3 Basking Sharks

Basking Sharks (*Cetorhinus maximus)* are protected in the Scottish Territorial Sea under Section 9(4A) and Schedule 5 of the Wildlife and Countryside Act 1981 (as amended by the Wildlife and Natural Environment (Scotland) Act 2011) from intentional or reckless disturbance or harassment. As well as being considered a PMF, in the UK they are a Priority Species under the UK Biodiversity Action Plan and internationally classified as Endangered on the International Union for the Conservation of Nature (IUCN) Red List and listed under CITES Appendix II.

A basking shark licence is required under the Wildlife and Countryside Act 1981 if any activity (e.g., commercial survey activities) within or related to the Offshore Proposed Development is likely to cause disturbance or injury to a basking shark. MD-LOT is the licensing authority for basking shark licences.

2.4.1.4 Nature Conservation Marine Protected Areas (NCMPAs)

NCMPAs protect nationally important marine habitats and species. Under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 MD-LOT must consider the likelihood that a licensable activity could impact upon protected features of a NCMPA (or any protected geomorphological or ecological process which a protected feature is dependent) and exercise its functions in a manner which best furthers the relevant conservation objectives. Any relevant NCMPAs are described within this Offshore Scoping Report and will be considered in detail within the subsequent EIAR.

2.5 Relevant UK and Scottish Marine Policy

A number of policy documents are available from the UK and Scottish Governments which will be used to inform the EIA process. Table 2.1 sets out the key policy documents that will be reviewed as part of the EIA.

Table 2.1: Key UK and Scottish Policy

Policy
UK Marine Policy Statement (HM Government, 2011)
UK Clean Growth Strategy: Leading the way to a low carbon future (HM Government, 2017)
UK Renewable Energy Roadmap: 2013 update (HM Government, 2013)
UK Industrial Strategy: building a Britain fit for the future – 2017 (HM Government, 2017)
Energy white paper: Powering our net zero future 2020 (HM Government 2021)
UK Net Zero Strategy: Build Back Greener 2021 (HM Government 2021)
National Policy Statements for energy infrastructure (HM Government 2023)
Scottish Electricity Generation Policy Statement (Scottish Government, 2013b)

Policy
Scotland's National Marine Plan: A Single Framework for Managing Our Seas (Scottish Government, 2015a)
Scottish Energy Strategy: The future of energy in Scotland (Scottish Government, 2017)
Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020a)
Sectoral Marine Plan - innovation and targeted oil and gas decarbonisation, initial plan framework (Scottish Government, 2022)
Climate Change Plan, Third on Proposals and Policies (2018-2032) (Scottish Government, 2018)
National Planning Framework 4 (Scottish Government, 2023b)
Shetland Energy Development Principles (Shetland Islands Council, 2022)
The Scottish Biodiversity Strategy to 2045: Tackling the Nature Emergency in Scotland (Scottish Government, 2022b)
The European Biodiversity Strategy for 2030 (European Commission, 2020)
Strategic Plan for Biodiversity – 2011-2020 (Convention on Biological Diversity 2010)
The UK Post-2010 Biodiversity Framework (JNCC 2012)

3 Description of the Offshore Proposed Development

3.1 Introduction

This chapter provides an overview of the components of the Offshore Proposed Development. The chapter also includes a description of the activities that will be carried out during the different stages of the Offshore Proposed Development (Construction; O&M; and Decommissioning) as well as indicative development timelines.

3.2 Location and Boundaries

The Offshore Proposed Development is located within the NE1 PO. The Array Areas cover a spatial footprint of 460 km^2, which includes the Arven Array Area (360 km^2) and the Arven South Array Area (100 km^2). The Offshore Proposed Development Array Areas are located 30 km from Mainland, Shetland at its closest point and the Offshore Proposed Development is currently anticipated to have a connection to the NETS on Mainland, Shetland.

The boundary within which all Offshore Proposed Development infrastructure will be located is displayed in Figure 1.1. The boundary encompasses the two Array Areas and a relatively wide area of search running into the east of Mainland Shetland within which OfECC(s) and landfall(s) will be located. The identification of and subsequent refinement of the OfECC(s) and landfall(s) will be informed by a number of factors, and that identification and refinement process will commence upon confirmation of onshore connection location(s) following conclusion of the National Grid Electricity System Operator (NGESO) Holistic Network Design Follow Up Exercise (HNDFUE).

3.2.1 Site Selection Overview and Current Status

The site selection process was primarily driven by Marine Scotland's (now Marine Directorate) Sectoral Marine Plan, and CES's ScotWind leasing process which is fully described in available literature (CES 2023; Scottish Government 2020a) and thus not repeated here, with the Developer recognising the potential to develop the NE1 PO released as part of the ScotWind Clearing Process. In advance of submitting a bid as part of this process both MRP and OW undertook desk-based reviews and studies of available data and initial stakeholder engagement to understand constraints to development within the PO area and identify preferred development areas. Environmental constraints mapping was undertaken via publicly available data. Desk-based engineering studies were undertaken to understand water depths, metocean conditions and seabed geology.

Subsequently lease areas within NE1 were awarded. Lease area 18 with a capacity of 500 MW was awarded to lead applicant OW and lease area 19 with a capacity of 1.8 GW was awarded to lead applicant MRP. A third lease area within NE1 was awarded to lead applicant ESB Asset Development.

Site selection of the OfECC(s) is ongoing. The Offshore Transmission Network Review (OTNR) was launched by the UK Government in 2020 and concluded in May 2023. The purpose of the OTNR was to ensure that the network connections for offshore wind generation are delivered efficiently and consider the environment, cost to consumers, local communities and deliverability (HM Government, 2022; NGESO, 2022). As part of the OTNR, NGESO completed the Holistic Network Design (HND) in July 2022 to determine the grid connection

recommendation for 23 GW of offshore wind in scope. NGESO recently undertook the HNDFUE to determine the grid connection recommendations for the remainder of the ScotWind leaseholders, including the Developer. The outcome of the HNDFUE was published in March 2024 (ESO, 2024) and indicates that the Project can assume a connection to the NETS on Mainland, Shetland, with a precise connection location yet to be confirmed. Any alternative route to market offtake is likely also to require a cabled connection to Mainland, Shetland. A process to identify and refine the OfECC(s) located within the current area of search will commence following determination by SSENT of the more precise location of the connection to the NETS on Mainland, Shetland. This exercise will be informed by engagement with stakeholders, in addition to analysis of technical and environmental constraints. The EIAR will present a refined OfECC.

The EIAR will set out the options considered for the Project and the main reasons for selecting the options chosen. The EIAR will take into consideration the environmental sensitivities, feasibility and the overall objectives of the Project whilst considering these options. In addition, the EIAR will also consider a 'no development option', which will outline the baseline scenario if the implementation of the Project were not to go forward.

3.3 Design Envelope Approach

The Developer has adopted a Design Envelope approach to impact assessment in line with guidance from the Scottish Government (2022). The Design Envelope approach offers flexibility in the EIA process by enabling an impact assessment to be carried out against several potential design options. At this time in the early stages of development, it is not possible to define exact specifications for infrastructure for the Offshore Proposed Development. In the offshore wind sector, improvements in technology and construction methodologies occur frequently and information provided as part of the consent application could become rapidly outdated, resulting in an uneconomical and potentially unbuildable project. Furthermore, key contracts are not placed until later in the development phase closer to construction, and detailed site investigation works will be required to inform the final design. In addition, the Floating Foundation technology concept is yet to be developed at a commercial level and there are many innovative and novel floating designs becoming available to the market. As such, the design envelope approach being applied allows for flexibility in design options where the final details of the Offshore Proposed Development are not known.

The Design Envelope will therefore identify a range of parameters associated with each aspect of the Offshore Proposed Development, enabling a realistic assessment of the likely worst-case environmental effects upon a particular receptor. Initial details on the key components for the Offshore Proposed Development are provided in the sections below. These parameters are indicative and informed by the experience of the Developer and will be refined as the Offshore Proposed Development progresses through the planning and development phase. The design envelope provided in the EIAR will provide additional details on key components of the Offshore Proposed Development as a reflection of design decisions made in the intervening period between Scoping and consent application submission. These design decisions will be informed by feedback from stakeholder engagement, environmental survey work, and technical and engineering studies, all of which support the EIA Process.

3.4 Development Phases

3.4.1 Construction

It is anticipated that the construction of the Offshore Proposed Development will commence in the early 2030s and take approximately four years, although this is subject to change. Construction works would be undertaken 24 hours a day, 7 days a week offshore, dependent upon weather conditions.

An indicative construction series is outlined below showing the key stages associated with the installation of the Offshore Proposed Development, noting that stages may take place in a different order to that listed:

- Pre-construction surveys, such as geophysical, geotechnical and unexploded ordnance (UXO) surveys;
- Site preparation, if required as a result of the pre-construction surveys, boulder and UXO clearance activities may also be undertaken;
- Installation of OSP(s) and associated foundations;
- Offshore Export Cable installation;
- Interconnector Cable installation;
- Pre-lay of anchors and moorings for Floating Foundations;
- Tow-out of pre-assembled WTGs and Floating Foundations and hook-up to moorings;
- Inter-array Cable installation;
- Testing and commissioning of OSPs, cables and WTGs.

Given the large maximum capacity of the Project and scope for multiple routes to market, there is potential for the Project to be built out in phases. Phasing scenarios will be further developed to inform detailed EIA. EIA scoping considers the entirety of the Offshore Proposed Development, observing that build out may follow various phasing scenarios as described in Table 3.1.

Table 3.1: Potential phasing scenarios for the construction of the Offshore Proposed Development

Potential phasing scenarios:	Single phase (Project constructed in single phase as single development).
	Sequential (with gap) (Project constructed in two or more phases, each occurring after the previous phase has completed).
	Sequential (overlapping) (Project constructed in two or more phases, construction overlapping but each component (e.g. WTGs) only occurring after the installation of that component in the previous phase has completed).
	Simultaneous (Project constructed in two or more phases, each constructed at the same time although not necessarily the same component being constructed at the same time).

3.4.2 Operation and Maintenance

It is anticipated that preventative, corrective, planned and unplanned maintenance activities will all be required. The O&M strategy for the Offshore Proposed Development is highly contingent upon the key infrastructure selected for the final Offshore Proposed Development design and will be confirmed post consent.

The O&M strategy will be finalised once the technical specifications of the Project are confirmed, including the WTG model, OSP approach, and final Project layout. The anticipated O&M requirements will be set out in the EIAR.

3.4.3 Decommissioning

OWF projects are required by the Energy Act 2004 and the Scotland Act 2016, to provide a Decommissioning Programme (DP) which covers the decommissioning of OREIs. This programme needs to be supported by appropriate financial security.

The DP will follow guidance from the Guidance Notes on Decommissioning of OREI under the Energy Act 2004 from the UK Department of Energy and Climate Change (DECC) (Department for Business Energy and Industrial Strategy, 2019) and the Guidance Notes for the Decommissioning of OREI in Scottish Waters or in the Scottish part of the Renewable Energy Zone under the Energy Act 2004 published by Scottish Government (Marine Scotland, 2022). Decommissioning activities will comply with all relevant legislation at that time.

3.5 Project Infrastructure Overview

The following key infrastructure components of the Offshore Proposed Development are included within the Design Envelope:

- WTGs, including associated infrastructure (nacelle and blades) and Floating Foundations;
- OSPs and Bottom-fixed Foundations or subsea substations;
- Scour protection for WTG and OSP foundations;
- Inter-array Cables between WTGs and between WTGs and OSPs or subsea substations;
- Interconnector Cables between OSPs or subsea substations (if required);
- Offshore Export Cables connecting the OSP(s) or subsea substations to Landfall; and
- Cable protection where required.

3.5.1 Wind Turbine Generators (WTGs)

WTGs transform wind energy into electricity and consist of rotor blades, towers, nacelles, hubs, generators, transformers, power electronics and control equipment. WTG technology is constantly evolving and several design options are currently under consideration by the Developer. The selection of the final model of WTG will be made post consent as part of the detailed design process. Depending on the final WTG size selected, the Project is expected to have a maximum of 161 WTGs. The final number of WTGs will be dependent on the capacity of individual WTGs used, as well as the environmental and engineering survey results.

Each WTG (including colours, marking and lighting) and any required aids to navigation will be designed in accordance with relevant guidance from Northern Lighthouse Board (NLB), the Civil Aviation Authority (CAA) and the MCA. The methods and locations for the fabrication and assembly of the WTGs are reliant on the supply chain availability and therefore are not yet known. The required modes of transportation for the WTGs to site offshore, whether as components or assembled, is also not yet known as this will depend upon the fabrication and assembly locations and type of Floating Foundation selected.

The layout of the WTGs will be developed to effectively make use of the available wind resource and suitability of seabed conditions, as well as ensuring that the environmental effects and impacts on other marine users (e.g. fisheries and shipping routes) are kept to a minimum.

The Design Envelope for the WTGs is displayed in Table 3.2. These are indicative maximum parameters and may be subject to refinement ahead of EIA.

Table 3.2: WTG parameters described within the Design Envelope

Parameter	Design Component
Maximum number of WTGs	161
Maximum rotor blade diameter (m)	310
Maximum nacelle height (m) above lowest astronomical tide (LAT)	204.1
Maximum blade tip height (m) above LAT	359.1
Minimum downwind spacing (m)	6-7 Diameters of WTG rotor blade diameter
Minimum crosswind spacing (m)	3-4 Diameters of WTG rotor blade diameter
Maximum swept area of WTG (km²)	7.32
Air gap (m) above MHWS	22 - 35

3.5.2 Offshore Substation Platforms (OSPs)

The OSPs are the interface between Inter-array Cables and the Offshore Export Cables, and transform the electricity generated by the WTGs to a higher voltage to allow for transmission to shore in an efficient way by reducing electrical losses.

The Design Envelope includes two approaches to the deployment of OSPs which results in the installation of either several smaller platforms or fewer larger platforms. The Design Envelope also allows for the deployment of subsea substations. The subsea substation is a novel concept in the context of offshore wind and would see the substation equipment located on the seabed. The maximum design scenario is presented in Table 3.3, with smaller scale components expected to be applicable to the smaller OSPs and larger scale components to the larger OSPs, and the foundation types are in Table 3.6.

Table 3.3: OSP parameters described within the Design Envelope

Design Area	Parameter	Design Component
OSP topside	Maximum number of platforms	Small OSP: 7 Large OSP: 3
	Length of topside (m)	35 - 115
	Width of topside (m)	20 - 90
	Height (LAT) (m)	30 - 80
Subsea substation	Maximum number of subsea units	9

Design Area	Parameter	Design Component
	Maximum seabed footprint (m)	30 x 30

3.5.3 Foundations (WTGs and OSPs)

The WTGs and OSPs will be attached to the seabed with Foundations.

The WTGs will be supported by a Floating Foundation which consists of a floating platform with associated mooring and anchoring systems to keep the foundation 'on station'. Analysis of the expected water depths and predicted geological conditions across the Array Areas, and consideration of the limitations of bottom-fixed foundations, has concluded that Floating Foundations are the most suitable and cost-effective solution for the Project. Water depths between 99 m and 137 m are expected across most of the Array Areas, with approximately 80% of the Array Areas between 115 m and 125 m, exceeding the limits of bottom-fixed foundations deployed to date. The hard and shallow bedrock expected across portions of the Array Areas would also present challenges for installation of bottom-fixed foundations. Figure 3.1 below represents the floating foundation types that are considered feasible for the Project and which are included in the Design Envelope. These are, from the left, barge, semi-submersible, spar and tension-leg platform. A more detailed description of each option and associated mooring systems is provided in Table 3.4. The associated mooring systems are attached to the seabed by an anchoring system. Figure 3.2 below represents the different anchoring solutions that could potentially be utilised. These include, from the left, drag embedment anchors, suction caissons, piles and gravity-based anchors. Based on the ground conditions a single solution or a combination of the below could be implemented.

3.5.3.1 Scour Protection

Scour protection may be required around Foundations to prevent the movement of seabed sediment as a result of the flow of water around the Foundation during the lifetime of the Project. The types of scour protection considered for each foundation type are listed in Table 3.5 and Table 3.6. Rock berms are piles of placed rock material, typically deposited around the Foundation from a fallpipe vessel. Rock bags are comprised of rocks within mesh bags, placed in situ by an offshore construction vessel.

Figure 3.1: Potential Floating Foundation types considered for the Offshore Proposed Development (from the left, barge, semi-submersible, spar and tension-leg platform)

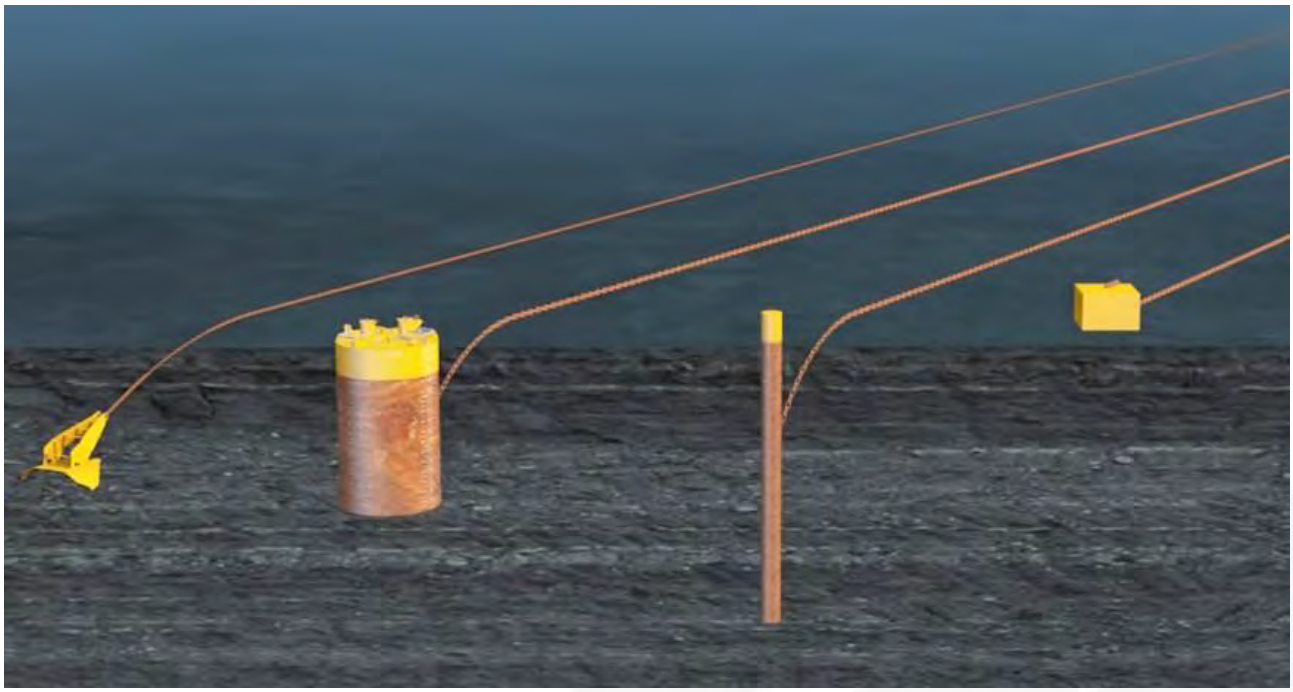


Figure 3.2: Potential anchoring solutions considered for the Offshore Proposed Development (from the left, drag embedment anchors, suction caissons, grouted piles and gravity-based anchors)

Table 3.4: Types of floating platforms considered for the Offshore Proposed Development

Floating Foundation	Description	Mooring system
Barge	A square flat-bottomed platform with a large surface area constructed of either concrete, steel or combination of both. It provides stability through buoyancy and ballast systems.	Catenary mooring system consisting of steel chains and synthetic ropes. Extending to a radius of 1,000m.
Semi-Submersible	A triangular platform featuring multiple buoyant columns or pontoons that are partially submerged in the water, creating stability, and allowing the platform to move with the motion of the waves. It can be constructed of either steel or concrete.	
Spar	A concrete vertical cylindrical column extending deep beneath the waterline, offering stability by minimising movement in response to waves and wind.	
Tension-Leg Platform	A pyramid shaped platform constructed out of steel tubulars held in position by tendons. It achieves stability by minimising horizontal movement caused by waves and wind.	Tendons (steel pipes or wire ropes) anchored directly below the platform. Up to 6 tendons per platform are considered.

The design parameters of the floating foundation types being considered for the Offshore Proposed Development are described in Table 3.5.

Table 3.5: WTG Floating Foundation parameters described within the Design Envelope

Floating Foundation Type	Parameter	Design Component
Barge	Floating platform dimensions (m)	70 x 70
	Depth of floating platform within the water column (i.e. draught) (m)	20
	Max number of mooring lines	9
	Max mooring line radius (m)	1,000
	Installation method	Tow-out of integrated WTG-platform unit to site
	Anchoring method	Gravity-based anchors, piles, drag embedment anchors, suction caissons; anchors may be driven, drilled and/or grouted; shared anchors/moorings may be used

Floating Foundation Type	Parameter	Design Component
	Scour protection	Protective rock berm or rock bags
Semi-Submersible	Floating platform dimensions (m)	120 x120
	Depth of floating platform within the water column (i.e. draught) (m)	20
	Max number of mooring lines	9
	Max mooring line radius (m)	1,000
	Installation method	Tow-out of integrated WTG-platform unit to site
	Anchoring method	Gravity based anchors, micropiles, shared anchors/moorings, drilled and grouted anchors, drag embedment anchor, suction caissons
	Scour protection	Protective rock berm or rock bags
Spar Platform	Floating platform dimensions (m)	35 m diameter of main body
	Depth of floating platform within the water column (i.e. draught) (m)	100
	Max number of mooring lines	6
	Max mooring line radius (m)	1,000
	Installation method	Tow-out of integrated WTG-platform unit to site
	Anchoring method	Gravity based anchors, micropiles, shared anchors/moorings, drilled and grouted anchors, drag embedment anchor, suction caissons
	Scour protection	Protective rock berm or rock bags
Tension Leg Platform	Floating platform dimensions (m)	100 x 100
	Depth of floating platform within the water column (i.e. draught) (m)	35m
	Number of tension legs	6
	Installation method	Installation of floating foundation followed by WTG installation

Floating Foundation Type	Parameter	Design Component
	Anchoring method	Gravity based anchors, micropiles, shared anchors/moorings, drilled and grouted anchors, drag embedment anchor, suction caissons
	Scour protection	Protective rock berm or rock bags.

The OSPs are expected to be secured to the seabed with a Bottom-fixed Foundation. The Bottom-fixed Foundations are typically fabricated from steel and/or concrete. Two Bottom-fixed Foundation options are currently under consideration, suction caisson jacket and pin piled jacket concepts described in Table 3.6, noting these would not be applicable in the case of the subsea substation option. Current concepts use mudmats (foundational elements for subsea equipment, providing stability and security on the seabed) and / or suction piles as part of the structure detailed in Table 3.3 to secure the subsea substation to the seabed.

Table 3.6: OSP Bottom-Fixed Foundation parameters described within the Design Envelope

Foundation Type	Parameter	Design Component
Jacket with pin piles	Number of piled jacket platforms	Small OSP: 7 Large OSP: 3
	Maximum number of legs per jacket	4
	Leg diameter (m)	3.5 - 5
	Number of piles per jacket	8 - 16
	Pin pile diameter (m)	2 - 4
	Maximum hammer energy (kJ)	3000 - 3600
	Mudmat diameter (m)	8 - 10
	Scour protection	Protective rock berm, rock bags, concrete mattresses, gabion mattresses, or frond mats
Jacket with suction caissons	Maximum number of jackets	Small OSP: 7 Large OSP: 3
	Number of suction caissons per jacket	4 - 6
	Suction caisson diameter (m)	10 - 12
	Suction caisson diameter with scour protection (m)	30 - 36
	Maximum height of suction caisson above seabed (m)	3
	Maximum penetration depth (m)	15
	Scour protection	Protective rock berm, rock bags, concrete mattresses, gabion mattresses, or frond mats

3.5.4 Inter-array Cables

Inter-array Cables (IACs) are used to connect WTGs to each other and to the OSP(s)/subsea substations. The layout of the IACs is highly dependent upon the WTG layout and as such will be defined at the final design stage post consent.

Where Floating Foundations are used, dynamic inter-array cables may be required. These are cables, or sections of cable, that are designed to accommodate the motions associated with the Floating Foundations to enable them to move with the foundation. Sections of the IACs where they are on the seabed will potentially be protected by burial, typically by ploughing, jetting or trenching, depending on the seabed conditions along the IAC routes. Cables for which optimal burial depths are not achievable may be subject to secondary protection measures such as rock placement or installation of concrete mattresses.

Subsea inter array cable collection units or junction boxes may be utilised within the Inter-array Cable configuration. These facilitate alternative Inter-array Cable configurations such as star or fishbone that may be required for effective floating arrays. The junction boxes themselves may be grouped into subsea modules that accommodate multiple WTG connections and a single connection to the OSP.

The IAC parameters included within the Design Envelope are described in Table 3.7.

Table 3.7: Inter-array cable parameters described within the Design Envelope

Parameter	Design Component
Maximum total cable length (km)	650 km
Maximum cable diameter (mm)	220
Cable burial method	Jet trencher, mechanical trencher, cable plough
Cable burial depth (m)	0 - 3
Maximum width of cable trench (m)	5
Maximum width of seabed affected by installation per cable (m)	20
Voltage (kV)	up to 132
Cable protection	Concrete mattresses, rock placement, cast iron shells or grout bags on the seabed. Bend stiffeners and cable protection systems where cables enter/exit WTGs.

3.5.5 Interconnector Cables

Interconnector Cables connect the OSP(s)/subsea substations to one another. As multiple OSP(s)/subsea substations are required, Interconnector Cables may be necessary in order to connect these to one another and improve the availability of the overall electrical system. The interconnector parameters included within the Design Envelope are described in Table 3.8.

Table 3.8: Interconnector cable parameters described within the Design Envelope

Parameter	Design Component
Maximum number of cables	up to 6
Maximum total cable length (km)	80
Voltage (kv)	up to 525
Cable type	3-core or single core, armoured subsea cable
Cable burial depth (m)	0-3
Protection method where burial not achieved	Concrete mattresses, rock placement, cast iron shells or grout bags on the seabed. Bend stiffeners and cable protection systems where cables enter/exit OSPs.

3.5.6 Offshore Export Cables

Offshore Export Cables will connect the OSPs/subsea substations to the Onshore Transmission Infrastructure allowing transfer of electricity from the wind farm either onwards through the NETS, or, to an alternative route to market.

Table 3.9: Offshore Export Cable parameters described within the Design Envelope

Parameter	Design Component
Number of cables	up to 8
Maximum total cable length (km)	750
Maximum cable diameter (mm)	300
Cable burial method – seaward of MLWS	Jet trencher, mechanical trencher, cable plough
Cable burial method – landward of MLWS	Trenching, jetting, ploughing, cutting, horizontal directional drill, direct pipe or other trenchless techniques
Target cable burial depth (m)	1
Maximum width of cable trench (m)	5
Maximum width of seabed disturbed by cable installation (per cable (m))	20
Voltage (kV)	up to 525
Cable protection and cable crossing material	Concrete mattresses, rock placement, cast iron shells or grout bags on the seabed. Bend stiffeners and cable protection systems where cables enter/exit OSPs.
Cable type	3-core or single core, armoured subsea cable.

3.6 Landfall Infrastructure

Multiple potential Landfall locations are currently being considered along the east coast of Mainland, Shetland. All locations considered fall within the scoping area boundaries (Figure 1.1). The Landfall area encompasses

the interface where the Offshore Export Cables and onshore cable circuits meet. Offshore Export Cables making Landfall will cross the intertidal area and land between MHWS and a transition joint bay (TJB). Cables are installed at the Landfall via one of two possible techniques:

- Open cut trenching installation; and/or
- Trenchless techniques (e.g. horizontal directional drilling (HDD) or direct pipe).

All infrastructure located above MHWS falls outside the scope of this Offshore Scoping Report. This infrastructure design will be detailed within the Onshore Scoping Report and assessed within the Onshore EIAR.

Table 3.10: Landfall parameters described within the Design Envelope

Parameter	Design Component
Maximum cable spacing at landfall (m)	50
Maximum width of foreshore affected by installation per cable (m)	15
Installation method	Trenching, jetting, ploughing, cutting, horizontal directional drill, direct pipe
Number of trenches/HDD duct	Up to 8
Number of transition joint bays	Up to 8
Each transition joint bay dimensions (m)	3 x 20
Landfall compound dimensions (m)	270 x 75

4 EIA Methodology

4.1 Introduction

EIA is the process of identifying and assessing the potential impacts of a proposed development on the environment. The EIA process will culminate in the production of an EIAR, written following the legislation and policy set out in Chapter 2: Legislation and Policy Context. This chapter presents the outline of the EIA methodology for the identification and evaluation of potential significant effects of the Offshore Proposed Development activities during construction, O&M, and decommissioning phases that would affect the environment, both individually and cumulatively with other proposed developments. This chapter also presents the methodology for the identification and evaluation of potential cumulative impacts and transboundary effects.

The EIA Process is delivered through several clearly defined stages, namely screening, scoping, environmental assessment, determination and post-consent monitoring. The EIA will be undertaken following the most recent and relevant legislation and policy as well as considering the relevant up to date guidance documents. A generalised list of guidance documents that will be applied during the EIA process has been set out below:

- Scottish Natural Heritage (SNH) (2018), 'A Handbook on Environmental Impact Assessment';
- Marine Scotland (2018), 'Marine Scotland Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy Applications';
- Institute of Environmental Management and Assessment (IEMA) (2015), 'IEMA Environmental Impact Assessment Guide to Shaping Quality Development';
- IEMA (2017), 'Delivering Proportionate EIA. A Collaborative Strategy for Enhancing UK EIA Practice';
- Chartered Institute for Ecology and Environmental Management (CIEEM) (2018), 'Guidelines for Ecological Impact Assessment in the UK and Ireland'. Terrestrial, Freshwater, Coastal and Marine;
- Oslo Paris Convention (OSPAR 2009).' Assessment of the Environmental Impacts of Cables';
- Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2004a), 'Offshore Wind Farms: Guidance Note for EIA in Respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) Requirements: Version 2';
- RenewableUK (2013), 'Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms';
- European Commission (1999), 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions';
- European Commission (2001), 'Assessment of plans and projects significantly affecting Natura 2000 sites';
- European Commission (2006), 'Nature and Biodiversity Cases Rulings of the European Court of Justice'; and
- European Commission (2017), 'EIA of Projects - Guidance on the preparation of the EIAR'. (Office for Official Publications of the European Communities 2017);
- Highways England (2019) 'Design Manual for Roads and Bridges (DMRB)'; and
- British Standards Institution ((BSI) (2015) 'Environmental Impact Assessment for Offshore Renewable Energy Projects – Guide'.

The full account of specific technical EIA guidance considered in relation to specialist topics will be documented in chapters 6-19 of this Offshore Scoping Report.

The Offshore Proposed Development has potential to cause a range of impacts on the surrounding physical, biological and human environment. When impacts are identified to have potential significant effects, mitigation measures will be taken to reduce or eliminate the impact where feasible. Within the IEMA Guide to Shaping Quality Development (IEMA, 2015), there are three types of mitigation measures identified. These include primary measures (modifications to the location or design of the Offshore Proposed Development), secondary measures (the implementation of further additional measures), and tertiary measures (management measures taken to meet legislative requirements or standard practice). The EIA process will also include proportionate measures to monitor the predicted impacts of the Offshore Proposed Development, where appropriate.

This chapter sets out the proposed methodology and approach to EIA for the Offshore Proposed Development including the general approach for the EIA process as well as describing the way impacts will be presented within the EIA.

4.2 Application of the Design Envelope

For the assessment of the Offshore Proposed Development, the Design Envelope approach to EIA will be adopted. The Design Envelope approach was originally established within onshore planning applications and allows for a reasonable range of potential project design parameters for certain key components to be considered and assessed for an offshore wind development, including type and number of WTGs; Floating Foundation type; location of the export cable route; location of an Onshore Substation; location of the connection point to the NETS; and construction methods and timings. If consent is granted on the assessed maximum parameters of the Offshore Proposed Development specified in the Design Envelope, parameters equal to or less than those assessed are permitted to be constructed. As long as the Project's technical and engineering parameters fall within the limits of the Design Envelope then those parameters are permitted within the consent, thus providing flexibility within the consent.

Chapter 3: Description of the Offshore Proposed Development describes the Design Envelope parameters for the Offshore Proposed Development and identifies the range of potential project design values for relevant components. For each technical topic chapter, the Design Envelope considered will be the design parameters that represent the greatest potential impact to each receptor considered (known as the Maximum Design Scenario or 'worst case') from the Design Envelope parameters and additional information relating to construction methods and schedules, vessel movements and decommissioning information. Once the Design Envelope has been developed for each receptor, it is checked to ensure the assessment covers all aspects of the design that could be constructed, while avoiding an unrealistic project design scenario. Therefore the 'worst case' scenario, is in fact the 'worst (realistic) case' scenario.

4.3 Application of a Proportionate EIA

The Offshore Scoping Report aims to provide a robust, yet proportionate EIA and a subsequent EIAR that will help to inform the decision-making process of the likely significant effects. A proportionate EIA is one which generates a clear, concise and informative report to deliver an effective and efficient assessment focusing on the potential significant effects of a project rather than all potential effects produced (such as those deemed insignificant). The need for proportionate and accessible EIAs has been recognised by regulators,

stakeholders and practitioners, and IEMA developed specific guidelines to follow to ensure the delivery of this standard (IEMA 2017). A proactive, early-stage scoping process ensures that the EIA process and the EIAR are robust and suitably focused on aspects of the environment likely to be impacted.

The Developer aims to ensure the production of a robust and proportionate EIA from the outset and our approach to producing this includes:

- A robust EIA scoping process with a thorough consideration of the standard industry best practice, and embedded commitments. These commitments are built into the Offshore Proposed Development concept rather than applied after a significant effect has been identified within the EIA process. A number of embedded commitments have been identified within the Offshore Proposed Development concept design and therefore have been identified within this Offshore Scoping Report;
- A Commitments Register (Appendix A) to be read in conjunction with the Offshore Scoping Report. This is a register that sets out all the specific mitigation measures that the Developer currently intends to adopt in relation to ensuring potential significant impacts are avoided, reduced or minimised. The Commitments Register will be maintained as a 'live' document and will be updated throughout the EIA process in order to ensure these commitments are fully integrated into the consent application process.
- An Impacts Register (Appendix B). This is a register that identifies all of the impacts considered within the Offshore Scoping Report and determines whether they are considered likely to be significant or not significant in EIA terms and sets out any embedded and project specific mitigation or management measures that are proposed. This is also a 'live' document that would be maintained throughout the EIA process, subsequent EIAR and consent submission. This register contains:
    - A list of all impacts considered within the Offshore Scoping Report;
    - A description of the relevance of each impact to the aspect and phase of the Offshore Proposed Development;
    - Mitigation measures that have been set out to mitigate or manage each impact;
    - The results of scoping;
    - The baseline characterisation result; and
    - Assessment Methodology.

4.3.1 Characterisation of the Baseline Environment

This section describes how the characterisation of the existing environment will be undertaken to determine the baseline environmental conditions within the Offshore Proposed Development and associated technical topic study areas. The future baseline will also be assessed for the impacts scoped into the EIAR in the case that the Offshore Proposed Development does not progress. This is a critical part of the EIA process as it provides a measure against which potential environmental effects can be assessed. Methods used to obtain the baseline will be clearly identified in each technical chapter and involve:

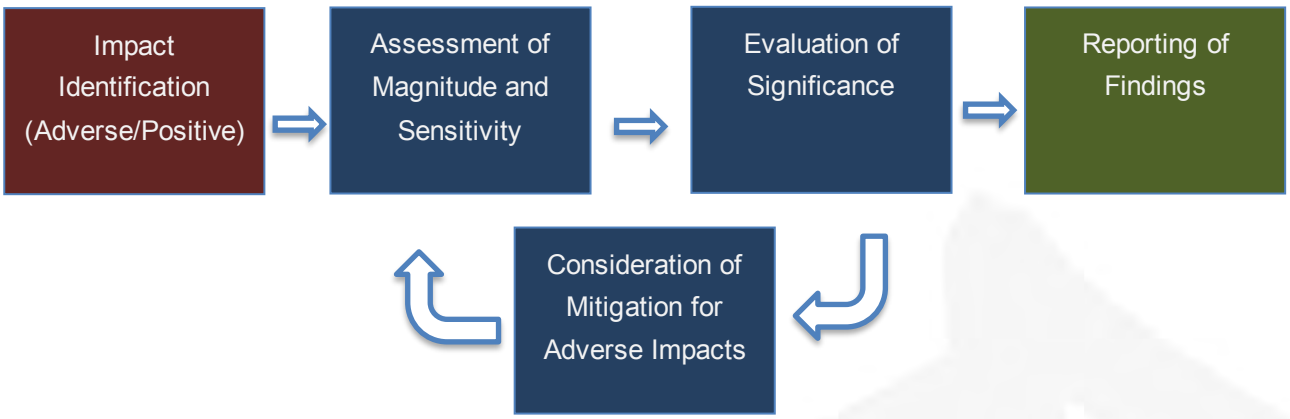
- Defining the study area for each technical topic and receptor, based on the related receptor's characteristics;
- Reviewing data available from other OWF projects in the baseline study area of the Offshore Proposed Development;
- Reviewing publicly available data and information;
- Considering the likely impacts and potential impacts that may arise as consequence of the Offshore Proposed Development, based on the Maximum Design Scenario;
- Determining whether there is enough necessary data to obtain the required EIA conclusions with adequate confidence;
- Ensuring that the data gathered is targeted and directed at answering the key questions and filling key data and knowledge gaps and determining if further data is necessary; and

- Reviewing the information collected to ensure the environmental baseline conditions can be sufficiently characterised in suitable detail.

4.3.2 Assessment of Potential Impacts

The Offshore Proposed Development has the capability to create a range of impacts on the surrounding environment and receptors. These impacts have been identified using a range of subjective and objective measures by which the significance of the impacts can be identified and the impacts are then considered to either be Scoped In, (i.e. where the impact may potentially give rise to a significant effect), or Scoped Out (i.e. where the impact is not considered likely to give rise to significant effects), of the subsequent EIAR. Embedded mitigation measures have been considered in the Offshore Scoping Report, which will be built into the proposed development concept through design or implementation of industry good practice

The potential impacts deemed to be Scoped into the EIA process for the Offshore Proposed Development will be described in the subsequent EIAR where the significance of effect will be established. The term 'effect' is identified as the consequence of an impact. In line with the EIA Regulations, the effects considered are only those where there is a risk of a potential significant effect. The EIAR will determine the evaluation of the significance of effect, this is influenced by the magnitude of the associated impact (i.e. how far the impact deviates from the established baseline conditions) and associated receptor sensitivity. The EIAR will determine the magnitude of the impact, the sensitivity of the receptor, and the significance of the effect, following the methodology outlined in Section 4.3.3 to 4.3.5 as well as any mitigation measures as indicated in the diagram below.



4.3.3 Defining Magnitude

The magnitude of an impact is the combination of the extent, duration, frequency, probability and consequences of an impact. A magnitude will be assigned to each impact assessed within the EIAR. The classification of magnitude of impacts may vary for individual pathways, receptors, and technical topics, however, will generally follow:

- Negligible; the very slightest change from the environmental baseline conditions;
- Low: the minor shift from environmental baseline conditions;
- Medium: the partial change or alteration to one or more key elements/features of the environmental baseline conditions; and
- High: the total change or major alteration to key elements and/or features of the environmental baseline conditions.

4.3.4 Defining Sensitivity

Receptors are defined as the physical, biological or human resource or group that would be affected by potential impacts. Defining the sensitivity of the receptor is reliant on the EIA topic concerned, and will generally take into account the tolerance, recoverability, importance, rarity, quality and value of the assessed receptor. However, the EIA topic or receptor in question always determines the type of scale of sensitivity for its given receptor. The ability for a receptor to adapt to change, tolerate and/or recover from potential impacts is pertinent in assessing its sensitivity to the impact under consideration. The scale of sensitivity will be classed as: Negligible, Low, Medium, or High.

When determining sensitivity during topic specific assessments the sensitivity scale will be further detailed where necessary. Designations, statutory protection and other guidance will also be taken into account in defining the value attributed to receptors as well as expert judgment being considered when determining the sensitivity of receptors.

4.3.5 Defining Evaluation of Significance

The significance of effect is determined by considering the magnitude of impact and the sensitivity of the receptor. To ensure consistency, a matrix will be used to assess the significance through a combination of magnitude and sensitivity, as presented in Table 4.1.

Table 4.1: Assessment of significant effects matrix

Significance of Effect		**Sensitivity of Receptor**			
		Negligible	**Low**	**Medium**	**High**
Magnitude of Effect	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Minor	Minor
	Medium	Negligible	Minor	Moderate	Moderate
	High	Negligible	Minor	Moderate	Major

For each receptor the EIA will provide specific definitions of the magnitude of impact, sensitivity of receptor and potential significance of effect. These topic specific definitions will reflect all relevant guidance and current published knowledge / research, alongside professional judgement which will be applied as required. The application of professional judgement is important to ensure effects are not inappropriately categorised in line with the matrix and allows justification for deviation from the matrix.

For the purposes of EIA, an effect of moderate or major significance will be considered a 'significant' effect and an effect of minor or less significance will be considered 'not significant'. Effects of moderate significance or above (see Table 4.1) will therefore be considered significant throughout the EIA process, whereas effects with minor or negligible significance merit little or no weight and will be considered not significant within the EIA process.

The matrix approach in Table 4.1 is consistent with the approach referred to in the Design Manual for Roads and Bridges (DMRB) (Highways England, 2019) and the Environmental Impact Assessment for Offshore Renewable Energy Projects – Guide (BSI, 2015). However, modifications have been made in the interest of proportionality. Negligible magnitude impacts will not be considered within the EIAR as they will always lead to 'not significant' effects, and receptors of negligible sensitivity will not be considered further for the same reason.

4.4 Cumulative Impact Assessment

The Cumulative Impact Assessment (CIA) considers the potential impacts that may occur cumulatively with other relevant plans, projects, and activities. According to the EIA Regulations, the Offshore Proposed Development must consider these cumulative impacts as well as considering the impacts from the Offshore Proposed Development alone. The CIA will assess the impacts cumulatively by considering any relevant plans, projects and activities that have already begun or are under construction, or those that have not been commenced but have a planning permission, or within the pre-application or application stages, which together may have a potential significant effect on a specific receptor due to a common impact pathway or temporal/spatial overlap. For completeness, certain technical chapters of the EIA consider impacts associated with other planned developments in the area, where relevant.

The following guidelines will be considered when undertaking the CIA:

- Guidelines on the Assessment of Indirect and Cumulative Impacts as well as Impact interactions (European Commission, 1999);
- Guiding Principles for Cumulative Impact Assessment in Offshore Wind Farms (RenewableUK, 2013); and
- Advice Note Seventeen: Cumulative Effects Assessment. Approach to Cumulative Impact Assessment methodology UK Planning Inspectorate (PINS) (2019).

A requirement of undertaking CIA is to identify projects, plans or activities to create a list of those that may act cumulatively with the Offshore Proposed Development, ensuring that all necessary plans, projects, and activities are included within the assessment. Information from each of these relevant plans, projects or activities including the most up to date project parameters, temporal, and spatial extents, will be used to inform topic specific CIA assessments. Where this information is not publicly available the Developer will seek to consult and cooperate to obtain these parameters for the CIA. The CIA will assess the impacts from each phase of the Offshore Proposed Development in relation to the other relevant plans, projects and activities to present an understanding of how these overlap.

There are a number of projects and plans within the vicinity of the Offshore Proposed Development that might contribute to cumulative impacts including other offshore wind projects, offshore renewable energy projects and subsea pipeline projects. Stoura OWF (being developed by ESB Asset Development) is another ScotWind project also located in the NE1 PO, which sits North of the Offshore Proposed Development. The OWF is also in the pre-planning stage. Further details on projects within the vicinity of the Offshore Proposed Development are available within Chapter 17: Other Marine Users and Infrastructure.

Each technical topic will take projects from all industries into consideration when assessing potential cumulative impacts associated with the Offshore Proposed Development on the surrounding environment and receptors.

The combined impacts of the Offshore Proposed Development and other projects, plans or activities on European sites are identified as in-combination effects. The potential in-combination effects on European sites will be reflected through the separate HRA process. A list of in-combination projects will be determined from those which are in planning, consented or in construction.

4.5 Interrelated and Transboundary Effects

Interrelated effects consider the potential for likely significant effects from the Offshore Proposed Development during construction, O&M and decommissioning affecting one receptor or multiple different impacts affecting the same receptor (e.g. noise, visual etc.) or even the same impact over different phases of the Offshore Proposed Development affecting the same receptor. The interrelated effects will be considered in each chapter topic for each relevant receptor within the EIA, through consideration of all effects on a receptor by the Offshore Proposed Development.

Transboundary effects occur when impacts from a project within one European Economic Area Member State's ('EEA State') territory may significantly affect the environment or the interests of another EEA State. The EIA Regulations require statutory notification and consultation in respect of transboundary effects of development in the UK on EEA States. As the UK is a signatory of the Espoo and Aarhus conventions, the Developer has obligations to engage with other signatory States and their public where relevant. The EIA process will therefore consider transboundary impacts where necessary.

4.6 Topics to be Scoped Out at EIA

This Offshore Scoping Report proposes a number of 'topics' to be scoped out of further assessment, as it is not anticipated that the Offshore Proposed Development would lead to potential significant effects on these topic areas thus, they are proposed for no further assessment within the pre-application process and EIAR. These are detailed within Table 4.2. Proposed scoping out of specific impacts (as opposed to topics) is summarised in Appendix B – Impacts Register

Table 4.2: Scoped out topics

Scoped out topic	Justification
Offshore airborne noise and vibration	The potential effects of airborne noise and vibration from offshore works (including cabling and Landfall works below MHWS) that have been identified to occur during the construction, O&M and decommissioning of the Offshore Proposed Development are proposed to be scoped out of the assessment as it is considered that no significant adverse effects will arise as described below: • Commercial vessels will maintain a minimum distance to pass construction activities. However, as vessels have a transient nature, they would be minimally exposed and would only be in the vicinity of construction and maintenance activities for a short period. When considering the existing

Scoped out topic	Justification
	sources of anthropogenic and natural airborne noise the effect of offshore airborne noise and vibration from piling on receptors onboard other transiting marine vessels is anticipated to be negligible. Supplementary construction noise will be expected to be localised around the vessels used for construction activities and will be unlikely to result in significant airborne noise when considering the vessel traffic already present in the area and other anthropogenic sources of noise. • Cable laying operations have generally low and localised noise emissions around the vessels undertaking the activity. These operations are generally short and transient in nature when the vessel moves along the cable laying route. • Noise relating to landfall operations will be localised, temporary, transient and of short duration. Anthropogenic noise in the surrounding area includes vessels, road traffic, residential, industrial noise and natural noise sources including precipitation, wave and wind action. Considering these existing noise sources it is considered that works within the intertidal area (up to MHWS) will not result in a significant impact to receptors. • WTG blade movement will result in low levels of airborne noise, far below that emitted during construction. As such, this is not anticipated to result in any significant impacts. • It has therefore been proposed that all sources of offshore noise and vibration are scoped out due to the lack of potential for significant impacts to arise, and embedded mitigation in the form of adherence to Environmental Management Plan (EMP) and a Piling Strategy (PS) in the event that piling activities are to be undertaken.
Offshore air quality	Vessel activities during construction, O&M and decommissioning will contribute to atmospheric emissions at a local level. However, the scale of these emissions will be small and, with the highest number of vessels used during the construction stage, the duration of these emissions will be largely temporary and short term. The main infrastructure of the Offshore Proposed Development will be present within the Array Areas and therefore will not interact with receptors relevant to air quality including those related to human health which are generally located onshore. Any receptors present in the vicinity of the offshore works will be of a short term and temporary nature. A Vessel Management Plan (VMP) will be put in place which will outline the final strategies across all phases of the Offshore Proposed Development lifecycle, ensuring the efficient use of vessels and ensure compliance with relevant international and national air quality standards and legislation. The number of vessels used throughout the lifecycle of the Project will be minimal in comparison to active vessels within the wider study area and would therefore have a minimal contribution to atmospheric emissions comparative to the baseline. It has therefore been proposed to scope out offshore air quality as there is no potential for significant effects to arise, and embedded mitigation measures (including adherence to the Emergency Response Cooperation Plan (ERCoP),

Scoped out topic	Justification
	EMP, and VMP) are considered to reduce any effects of the potential impacts further.
Major accidents and disasters	There is a potential for major accidents or disasters due to the nature and location of the works (i.e. at sea, close proximity to high-risk infrastructure and work involving vessels and heavy equipment). However, the construction and O&M of offshore developments including offshore wind is a well-established practice and through careful site selection and adherence to all relevant plans and policies and appropriate mitigation measures (ERCoP, EMP and VMP), the risk is minimised as far as reasonably practicable and the potential for major accidents and disasters is considered highly unlikely. Where necessary and following the findings of this Offshore Scoping Report, individual topic EIAR chapters (e.g. Chapter 17: Other Marine Users and Infrastructure and Chapter 15: Shipping and Navigation) will contain an assessment of the potential effects arising from any accident and disaster scenarios that may arise, or be caused, and the associated mitigation measures which will be employed to prevent, reduce and/or control these.
Human health	A standalone chapter for human health has not been provided within this Offshore Scoping Report, as potential effects on human health will be considered either within relevant technical Chapters or within a specific 'Human Health' chapter of the Onshore Scoping Report.

5 Consultation

5.1 Introduction

The Developer is committed to meaningful and robust consultation and engagement. Within the EIA process, engagement with statutory and non-statutory consultees and the public is key for the successful delivery of an OWF development. Consultation throughout the pre-application process and beyond is important to enable the integration of stakeholder and public feedback into the decision-making and design process. This will ensure a robust EIA application that considers the potential environmental, community, and socio-economic receptors that may be brought up within consultation and engagement with stakeholders. Statutory and non-statutory stakeholder engagement and consultation has commenced, including a widely publicised and reported offshore public consultation event, and will continue to be undertaken by the Developer to give interested parties the opportunity to feedback on all aspects of the Offshore Proposed Development. This chapter of the Offshore Scoping Report presents both the completed and planned consultation relevant to the Offshore Proposed Development.

Stakeholder engagement and consultation comprises the provision of information to relevant stakeholders and the local community to enable understanding of the Project and gives the opportunity for the community and stakeholders to express their views and feedback in relation to the Offshore Proposed Development. Community and stakeholder engagement will be provided in accordance with relevant legislation, guidance and best practice.

An overview of the consultation undertaken to date is presented in section 5.3.

5.2 Requirement for Statutory Consultation and Relevant Legislation

As mentioned within Chapter 2: Legislation and Policy Context, the Developer will undertake the EIA and application processes following statutory and best practice requirements regarding consultation and stakeholder engagement. These include:

- Marine (Scotland) Act 2010 and the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013 (PAC Regulations) - applications for a marine licence under Part 4 of the Marine (Scotland) Act 2010 require at least one pre-application consultation event to be held. The event is to provide statutory stakeholders and members of the public the opportunity to review and comment on the proposals. There are detailed advertisement requirements, including a requirement to publish a notice in a local newspaper at least six weeks before the event.
- The EIA Regulations – the Scottish Ministers must consult with the relevant consultation bodies and any other public body which is likely to have an interest in the Offshore Proposed Development before adopting a scoping opinion and on receipt of an EIA report and take any relevant representations into account.
- Section 36 consent under the Electricity Act 1989 and marine licensing under Part 4 of the Marine and Coastal Access Act 2009 – there are no formal consultation requirements in respect of these applications, but the Developer will be undertaking consultation in accordance with the above requirements which will inform the relevant Section 36 consent and marine licence applications.

Further guiding principles for engagement include:

- Scottish Government's Consultation Good Practice Guidance (2019b);
- Scottish Community Development Centre's National Standards for Community Engagement (2020a);
- Scottish Community Development Centre's National Standards for Community Engagement: Engaging with our communities to support recovery and renewal (2020);
- Scottish Government's Effective Community Engagement in Local Development Planning Guidance: Consultation Draft (2023e);
- Planning Advice Note PAN3/2010 Community Engagement (Scottish Government 2010);
- International Association for Public Participation's Public Participation Pillars (2024); and
- Planning Aid Scotland's Scottish Planning = Effective Engagement and Delivery (SP=EED) framework (2011).

In accordance with the statutory and best practice requirements, consultation for the Offshore Proposed Development will include one or more public consultation events together, where possible, with online consultation options to encourage wider access and participation.

Consultation and stakeholder engagement associated with the Project's onshore consent requirements will also be undertaken at the appropriate time and will be aligned where possible to avoid repetition. In keeping with the requirements of the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013, as required by the Town and Country Planning (Scotland) Act 1997, the Developer proposes at least two onshore public consultation event(s) - including online consultation options - aimed at replicating the offshore public consultation event(s). Details of these offshore and onshore consultation events will be included within a detailed PAC report which will accompany the Project's EIAR.

The Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (the 'Aarhus Convention'), to which the United Kingdom (UK) is a signatory, gives individuals the right to access information, public participation in decision-making and access to justice in environmental matters. The Aarhus Convention was created to empower the role of citizens and civil society organisations in environmental matters and is founded on the principles of participative democracy. The EIA process will be undertaken in line with the Aarhus convention regarding the rights of the general public to environmental information including:

- the right to receive environmental information held by public authorities;
- the right to participation in decision-making regarding the environment; and
- the right to review procedures and challenge decisions that have been made without due regard to public review or input.

In accordance with Habitat Regulations, a Report to Inform Appropriate Assessment (RIAA) will be provided if necessary (depending on the outcome of the Scoping Opinion and Offshore HRA Screening Report) (see Section 2.4.1 within Chapter 2: Legislation and Policy Context).

The National Standards for Community Engagement (Scottish Community Development Centre 2020) ensure inclusiveness and equality during the consultation process. Consenting guidance and advice given by statutory stakeholders such as MD-LOT and NatureScot regarding consultation and communication with stakeholders will be taken into account by the Developer.

5.3 Consultation To Date

The Developer actively began an early process of engaging with key statutory stakeholders with meetings held to introduce stakeholders to the Project and the Developer. Consultation with stakeholders began in December 2022.

The Developer continues to participate in Quarterly Project Update Meetings with MD-LOT and NatureScot which began in January 2023. These meetings include discussions related to (but not limited to) the following:

- Project updates from the Developer;
- Provision of any industry updates on new guidance/research projects or upcoming developments or changes to the consenting process from MD-LOT and/or NatureScot; and
- Discussion regarding approaches to baseline data gathering to inform EIA and approaches to impact assessment.

Pre-scoping consultation workshops were held on the 28th and 29th November 2023 and covered a number of key technical aspects (physical processes, marine mammals, ornithology, benthic ecology and fish ecology) of the Offshore Scoping Report and how any potential issues might be addressed ahead of the Developer's request for a Scoping Opinion. Feedback on other technical topics that were not directly discussed in workshops is being sought via the request for a Scoping Opinion. Stakeholders that attended the meetings included:

- MD-LOT;
- Marine Directorate – Science, Evidence, Data and Digital (MD-SEDD);
- NatureScot;
- Shetland Islands Council;
- University of Highlands and Islands – Shetland (UHI Shetland);
- RSPB; and
- Scottish Oceans Institute - St. Andrews.

The Developer has, alongside ESB Asset Development who are developing the Stoura OWF, established an NE1 Fishing Forum which has met on four occasions to date, and which will continue to meet regularly. These meetings allow the NE1 developers to provide project updates to representatives of the Shetland and Scottish commercial fishing industry, to seek the views of commercial fisheries stakeholders and to share information and data. As part of the November 2023 meeting, the offshore EIA scoping process and sources of baseline data were discussed. Attendees included representatives from:

- Shetland Fishermen's Association (SFA);
- Shetland Shellfish Management Organisation (SSMO);
- Scottish White Fish Producers Association;
- Scottish Fishermen's Federation (SFF); and
- Scottish Pelagic Fishermen's Association (SPFA).

The developer also undertook a pre-scoping meeting with aquaculture representatives on the 20th November 2023. Attendees included:

- Seafood Shetland;
- Salmon Scotland; and

- Shetland mussel farming industry representative.

In recognition of the potential cumulative impacts that may arise from projects within the NE1 PO, the Developer has also been engaging with ESB Asset Development on various aspects of project development where appropriate. This collaborative engagement remains ongoing and is intended to allow, among other aims, collaborative workstreams to be progressed, avoid duplication (where possible), and to allow information sharing to understand potential for, and opportunity to reduce, cumulative impacts and develop local supply chain; O&M; and community benefits as far as possible.

Other consultation, including direct community consultation, that has taken place is summarised below:

- Continued consultation/engagement with SIC including quarterly project update meetings . A project and scoping update was provided as part of a wider SIC meeting on the 22nd November 2023. Attendees included those from all relevant departments, both onshore-facing and offshore-facing, within SIC.
- Bi-monthly Shetland stakeholder meetings with the '4Shetland' group. This group includes stakeholders such as the SIC, Lerwick Port Authority, Highlands and Islands Enterprise, Orion, several supply chain representatives via the 'NORN engineering Alliance' and ESB Asset Development. This group is focused on maximising economic development opportunities for Shetland from the NE1 projects.
- Consultation with Members of the Scottish Parliament (MSPs) and MPs has been ongoing since November 2022, including meetings/engagement with the MSP for Shetland, MP for Orkney and Shetland, and the Cabinet Secretary for Net Zero, Energy and Transport.
- Ongoing engagement with NGESO and SSENT in relation to the Holistic Network Design Follow Up Exercise (HNDFUE) and the Project's grid application;
- Ongoing engagement with the UHI Shetland to share details of the environmental work and to explore the potential for UHI Shetland to support the Project.
- Engagement continues with the local fishing industry, directly through the NE1 Fishing Forum mentioned above, but also more widely. The Developer has prioritised keeping the fishing industry informed of project progress and activities and is also a member of the Shetland Islands Council Fisheries and Aquaculture Working Group, last attending on 22nd September 2023 alongside ESB Asset Development.
- A high profile, widely publicised and reported, Arven public exhibition/consultation event was held in Lerwick on 21st February 2024 to provide Shetland-based stakeholders and members of the public with an opportunity to learn more about the Project and to raise awareness of the planned offshore EIA scoping exercise. The event was attended by almost 90 visitors, a number of whom completed questionnaires seeking feedback on the Project and preferred approaches to ongoing engagement. Attendees included: members of the public; port representatives; SIC councillors; community councillors; council officials; local supply chain representatives, fishing skippers; fishing industry representatives; development agencies; and environmental agencies. A virtual version of the exhibition is available on the Arven website: https://www.arvenoffshorewind.com/exhibition/
- It is intended to replicate this public exhibition/consultation event to cover onshore elements of the Project, later, once onshore locations have been better informed by NGESO's HND FUE (which is expected to have established outcomes through 2024). Details of these public exhibition/consultation events will be included, alongside all statutory and non-statutory stakeholder consultation within a comprehensive PAC Report to accompany the Project's EIAR.

5.4 Stakeholder Identification

A list of the organisations that the Developer has already engaged with, or expects to engage with, regarding assessment and consenting matters during pre-application is displayed in Table 5.1.

Table 5.1: Stakeholders identified for engagement as part of the Pre-application Process

Type	Stakeholder/Organisation
Governmental / Statutory	• CES; • MoD; • Historic Environment Scotland (HES); • JNCC; • MD-SEDD; • MCA; • MD-LOT; • NatureScot; • NLB; • Office of Gas and Electricity Markets (Ofgem); • Relevant Planning Authorities (including, principally, SIC Coastal and Marine Planning) • SEPA; • Scottish Government (Marine Directorate) Policy Team; • Relevant Departments within the Scottish Government e.g., – Energy Consents Unit • Transport Scotland; • Joint Radio Company (JRC).
Transmission Network Operators / Owners	• National Grid Electricity System Operator (NGESO); • Scottish and Southern Electricity Networks Transmission (SSENT).
Politically Established Interest Organisations	• 4Shetland; • Committee on Climate Change (CCC); • Highland and Islands Enterprise (Shetland); • Lord Lieutenant; • Scottish Development International; • Scottish Enterprise; • UHI Shetland.
Fisheries and Aquaculture	• Cooke Aquaculture; • Scottish Sea Farms; • EU and Norwegian fishing industry representatives; • Fisheries Research Services; • L.H.D Limited; • Local fishing organisations / fishing skippers/ fishermen; • Local aquaculture operators; • NE1 Fishing Forum;

Type	Stakeholder/Organisation
	• Regional Inshore Fisheries Group1; • Salmon Fisheries Board and Trust; • Salmon Scotland; • SFF; • Scottish Pelagic Fishermen's Association; • Scottish White Fish Producers Association; • Seafood Shetland; • Shetland Fish Producers Organisation; • SFA; • Shetland Islands Council - Fisheries and Aquaculture Working Group; • SSMO.
Environmental Organisations	• British Trust for Ornithology; • Cetacean Research & Rescue Unit; • Marine Conservation Society; • National Trust for Scotland; • Royal Society for the Protection of Birds (RSPB); • Scottish Environment Link; • Scottish Wildlife Trust (SWT); • Sea Mammal Research Unit (SMRU); • Shetland Amenity Trust; • Shetland Bird Club; • Shetland Charitable Trust; • Whale and Dolphin Conservation (WDC).
Ports and Navigation	• Chamber of Shipping; • Lerwick Port Authority; • NorthLink Ferries; • Aquaculture vessel service providers; • Royal National Lifeboat Institution (RNLI); • Royal Yachting Association (RYA); • Shetland Islands Council Ferry Services; • Shetland Islands Council/ Port of Sullom Voe/Scalloway Harbour/Small Ports; • UK Hydrographic Office (UKHO).
Aviation	• Aberdeen International Airport; • British Airports Authority (BAA); • CAA; • Highlands and Islands Airports Limited (HIAL);

[1] The Regional Inshore Fisheries Groups are non-statutory bodies that aim to improve the management of fisheries in the 0-12 nautical mile zone of Scottish waters and to give commercial inshore fishers a strong voice in wider marine planning initiatives

Type	Stakeholder/Organisation
	• National Air Traffic Services (NATS).
Tourism and Recreation	• Mountaineering Scotland; • Shetland Tourism Association; • Sub Aqua and Scuba Diving Clubs; • Surfers Against Sewage; • Visit Scotland.
Wind Energy Interest	• Energy Isles; • Norn Engineering Alliance; • North Yell Development Council • ORION clean energy; • Other offshore wind developers; • ESB Asset Development – Stoura; • Shetland Aerogenerators; • Shetland Community Benefit Fund; • SSE Renewables; • Statkraft; • Voar Energy.
Supply and Industry	• Suppliers of local services (e.g. vessel providers, environmental and site investigation survey providers, port and harbour operators, manufacturing and installation contractors).
Other	• Landowners; • Local communities and representatives; • Media, Public Relations; • Net Zero Technology Centre - Pan Islands Green Hydrogen Initiative; • Oil and gas operators; • Scottish gas distributors; • Spaceport operator.

5.5 Future Stakeholder Engagement

The Developer intends to adhere to all statutory consultation requirements required as part of the consenting process and will follow best practice guidance where necessary. Engagement with stakeholders and the Shetland community will be focused on the following stages:

- Formal submission of this Offshore Scoping Report and request for a Scoping Opinion from the Scottish Ministers;
- Continued engagement with the MD-LOT / NatureScot via Quarterly Project Update Meetings;
- Continued engagement with SIC via Quarterly Project Update Meetings;
- Continuation of NE1 Fishing Forum Meetings approximately three times per year;
- Continued participation in SIC Fisheries and Aquaculture Working Group;
- Consultation with Regulatory Authorities (technical advisors) on the survey scopes of work for key survey campaigns, and liaison regarding Marine Licence and EPS risk assessment requirements to allow surveys to proceed;

- Consultation with key statutory and non-statutory consultees on specific technical aspects including but not limited to commercial fisheries, ornithology, marine mammals, shipping and navigation, aviation and archaeology and cultural heritage;
- Provision of key technical reports and data, used to inform the assessments, to relevant stakeholders for information and feedback as requested, to the extent considered beneficial by the Developer (e.g. Digital Aerial Survey (DAS) Reports);
- Additional public/stakeholder-specific engagement/consultation events (including online options to widen access and participation) at appropriate intervals during the consenting process, together with the issue of project communications and making documentation available on the Project's website;
- Completion of statutory PAC Report;
- Formal submission and publication of consent applications and the accompanying EIAR to seek consent and required licences for the Offshore Proposed Development.

The Developer will continue to engage with relevant stakeholders and the Shetland community throughout the development stages of the Offshore Proposed Development and subsequent construction lifecycle (pre-application, application submission and review, pre-construction, construction, commissioning), O&M and decommissioning. The Developer has detailed the key stakeholders it plans to engage with and is engaging in line with a project-specific Stakeholder Management Plan.

6 Marine Geology, Oceanography and Physical Process

6.1 Introduction

This chapter of the Offshore Scoping Report identifies the marine and coastal processes pathways and receptors of relevance to the Offshore Proposed Development and considers the potential impacts from the construction, O&M, and decommissioning of the Offshore Proposed Development upon marine geology, oceanography and physical processes, up to MHWS.

For the purposes of both this Offshore Scoping Report and the subsequent EIAR, marine geology, oceanography and physical processes include the following elements:

- Morphology, including bathymetry, geology, surficial sediments, seabed features and coastal form;
- Sediment transport, including bedload and suspended sediment; and
- Hydrodynamics, including tidal and non-tidal influences, and waves.

Marine geology, oceanography and physical processes pathways are closely linked to seabed, coastal and water quality receptors. This chapter should be read alongside:

- Chapter 7: Marine Water & Sediment Quality; and
- Chapter 8: Benthic Subtidal and Intertidal Ecology.

This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants Ltd.

6.2 Study Area

The marine and coastal processes study area is presented spatially in Figure 6.1. The study area is defined by the Offshore Proposed Development's footprint (including the Array Areas and the OfECC Area of Search), plus a buffer which represents a wider Zone of Influence (ZoI) associated with one spring tidal ellipse excursion of approximately 12 km.

The study area may be further refined during the EIA process using a more detailed consideration of tidal ellipse and sediment plume dispersion.

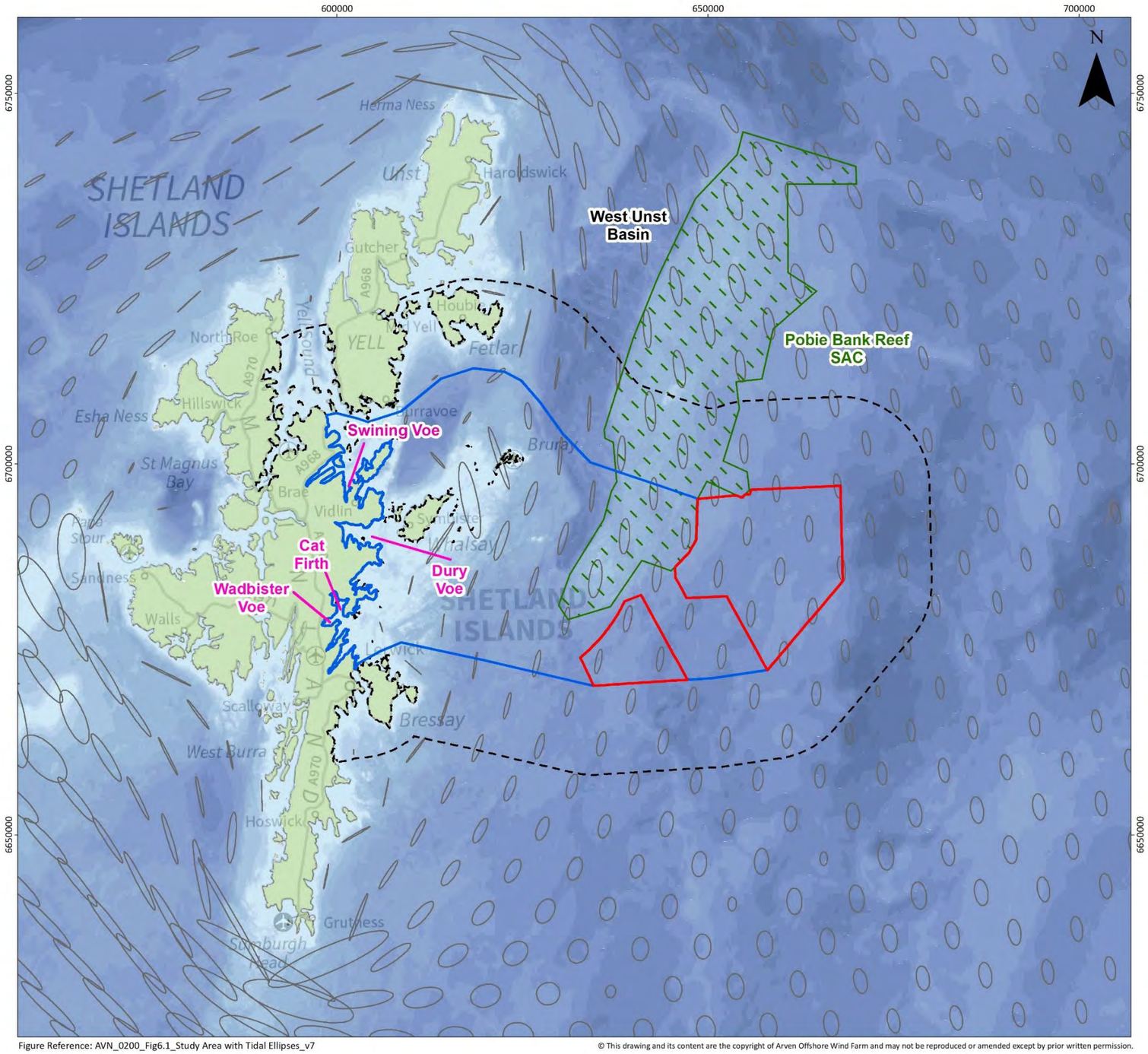


Figure Reference: AVN_0200_Fig6.1_Study Area with Tidal Ellipses_v7

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Marine and Coastal Processes Study Area with Tidal Ellipses

Legend

- Array Areas
- Offshore ECC Area of Search
- Special Area of Conservation
- 12km Zone of Influence
- Spring Tidal Ellipses

Depth (m)

- 0 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 110
- 110 - 120
- 120 - 130
- 130 - 140
- 140 - 150
- 150 - 160
- 160 - 170
- 170 - 180

Notes

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Coordinate System: WGS 1984 UTM Zone 30N

0 10 20 km

0 5 10 nm

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Figure 6.1

Figure 6.1: Marine Geology, Oceanography and Physical Processes: Study Area with Tidal Ellipses

6.3 Data Sources at Scoping

For the purposes of this Offshore Scoping Report, a desk-based review of existing and known publicly available data and literature has been undertaken using spatial and scientific data sources presented within Table 6.1. These data sources will be taken forward, reviewed and updated as appropriate, to inform the subsequent EIA, along with additional site-specific data that is to be collected for the Offshore Proposed Development.

Table 6.1: Data Sources used in Marine Geology, Oceanography and Physical Processes

Title	Summary	Source	Author and year
Morphology (bathymetry, geology, surficial sediments, seabed features and coastal form)			
Benthic Subtidal and Intertidal Ecology Survey Campaign (Array Areas)	Particle Size Analysis (PSA) characteristics from grab samples. Full coverage of Array Areas and part of adjacent SAC.	Held by Developer	Ocean Ecology 2023
Pobie Bank 2013 Biodiversity and 2009 Site Interpretation Data	Biodiversity analysis from surveying at Pobie Bank in 2013 and site data used as an input to SAC habitat maps.	Provided by JNCC	JNCC, 2009 & 2013
Pobie Bank Reef SAC Site Condition Assessment	Detailed information about the Pobie Bank Reef site and evaluation of interest features according to the Habitats Directive selection criteria and guiding principles (including feature mapping). Further JNCC-led surveys of Pobie Bank SAC were undertaken in 2020 and 2023, with JNCC confirming that outputs from these surveys are not yet available. Data will be used to inform EIA where it becomes available within the relevant timeframe.	https://data.jncc.gov.uk/data/748a0001-ac8a-4ae0-95df-ece63e02a57f/PBR-SAC-SAD-v5.0.pdfq	JNCC 2012

Title	Summary	Source	Author and year
European Marine Observation and Data Network, EMODnet Data Portal	Interactive bathymetry, geology and surficial sediment maps. Data provides UK-wide coverage for use in baseline characterisation. Represents most up-to-date data source for regional characterisation. Offers full coverage (Array Areas and OfECC).	EMODnet Map Viewer (europa.eu)	EMODNet (2023)
Coastal Directory Series: Region 1 Report Shetland	Regional characterization of geology, morphology, coastal processes, and form. Provides regional summary of coastal form including Landfall area. Has partial coverage of Array Areas and OfECC.	JNCC	Barne *et al.*, (1996)
Offshore GeoIndex Map	Seabed sediment maps (based on Folk classification) and borehole records from point locations. Data gaps exist in the coastal zone. Coarse data resolution with no returns in the coastal zone. There are no expected updates to this map. Full coverage (Array Areas) and partial coverage (OfECC)	GeoIndex Offshore | BGS	British Geological Survey (BGS) (2020)
Structure of the East Shetland Platform, Northern North Sea,	Geological description of the offshore and onshore stratigraphy Full coverage of Array Areas.	Petroleum Geoscience Volume 4, Issue 4	Platt *et al.*., (1998)

Title	Summary	Source	Author and year
Seabed and Superficial Geology and Sediments Survey report	Regional characterisation of geology, morphology, surficial sediments, and sediment transport. Partial coverage of Array Areas and OfECC	Strategic Environmental Assessment 5 – SEA5	SEA5 (2004)
Assessment: Cell 11 - Shetland	This document discusses Historical Change and Vulnerability Assessment for Scotland's soft coastline, using coastal cells to analyse coastal processes, changes, and impacts. Partial coverage of OfECC not Array Areas.	Dynamic Coast - National Coastal Change (NCCA)	NCCA (2017)
Sediment Transport			
Coastal Cells in Scotland, Cell 11	Regional characterisation of sediment transport, geology, morphology, and coastal form, focused on nearshore processes. Summary of coastal form including landfall area. There are no expected updates to this report. Partial coverage of OfECC and Array Areas	Scottish Natural Heritage	Ramsay and Brampton (2000),
Suspended Sediment Climatology's around the UK	Monthly and seasonal Suspended Particulate Matter (SPM) maps. SPM concentrations in surface waters derived from satellite data for the period 1998 to 2015. Does not directly cover the Array Areas or OfECC.	Cefas	Cefas (2016)

Title	Summary	Source	Author and year
Metocean Data (tides, non-tidal influences, waves, and frontal zones and stratification)			
The Scottish Shelf Model: Shetland	Shetland model is an implementation of the Finite Volume Community Ocean Model (FVCOM) and has a domain covering the northern isles of Shetland. Away from Shetland towards the open boundary, the grid matches that of the wider Scottish Shelf Model. The water column is resolved 10 layers, each representing 10 % of the water column. The Shetland model does not currently provide hindcast or climatologies as (of 2021) it was still under development. Full coverage of Array Areas and OfECC.	Marine Scotland Science	Marine Scotland Science (2021)
Atlas of UK Marine Renewables Energy Resources	Low resolution modelled hindcast wave, wind and hydrodynamic data. Summary data provided only. Coarse resolution of wave, tide and wind parameters derived from hindcast numerical modelling. Full coverage of Array Areas and OfECC.	UK Renewables Atlas - ABPmer (renewables-atlas.info)	ABPmer (2008)
Cormorant A Wave Buoy	Wave buoy data from 150 km northeast of the Array Areas	Wavenet, Cefas (wavenet.cefas.co.uk)	Cefas (2023)

Title	Summary	Source	Author and year
SEASTATES Metocean Data and Statistics Map	Modelled hindcast wave and hydrodynamic data. Coarse resolution of wave parameters derived from hindcast numerical modelling. Full coverage of Array Areas and OfECC.	SEASTATES - ABPmer's Metocean Information Service	ABPmer (2018)
British Oceanographic Data Centre	Hydrodynamic data (including current speed and direction, and depth profiles of water temperature and salinity) from point locations within the study area. Measured data for different locations within the Array Areas for a range of temporal periods and from different years. Collected using a range of instruments by different survey contractors. Partial coverage of Array Areas and OfECC.	National Oceanographic Database (NODB) Currents — Search (bodc.ac.uk)	British Oceanographic Data Centre (BODC) (2022)
Frontal Mapping	Frontal systems maps from around the UK, various data sources, however variability in the results due to the nature of fronts. Ful coverage of Array Areas and OfECC.	Deep Sea Research II	Miller *et al.*., (2014)
Marine Scotland National Matine Plan interactive (NMPi), interactive map	Hydrodynamic data (including current speed and direction, and depth profiles of water temperature and salinity) and geological and geomorphological data from point locations within the study area. Full coverage of Array Areas and OfECC.	Marine Scotland - National Marine Plan Interactive (atkinsgeospatial.com)	Marine Scotland (2023)

Title	Summary	Source	Author and year
National Tide and Sea Level Facility (NTSLF) (2020)	Tidal wave levels from point locations at the coast. Tidal data from Lerwick, 40 km from Array Areas and 1 km from OfECC boundary limits. Partial coverage of OfECC.	National Tidal and Sea Level Facility (ntslf.org)	NTSLF (2020)
Future changes			
Coastal Futures interactive Map	Sea level rise predictions for coastal locations and assessments of shoreline behaviour. Partial coverage of the OfECC.	Institute of Highway Engineers	Delft, 2021
Marine Report	Sea level rise predictions for coastal locations around the UK. Full coverage of Array Areas and OfECC.	UK Climate Projections Science report (UKCP18); Climate Change 2023: Synthesis Report	Palmer *et al.*., 2018; IPCC (2023)
Scotland's Coastal Change Assessment	Sea level rise predictions for coastal locations around Scotland. Partial coverage of OfECC.	Dynamic Coast 2, Centre of Expertise for Waters (CREW)	CREW, 2021

6.4 Pre-Scoping Engagement

A pre-scoping workshop was held to discuss the scope of the EIA for this topic. The following organisations participated in the workshop:

- The Developer;
- GoBe Consultants;
- MD-LOT;
- MD-SEDD;
- NatureScot;
- Shetland Islands Council; and
- UHI Shetland.

During and following the workshop, guidance was provided by NatureScot with respect to avoiding or minimising impacts to the Pobie Bank SAC through fully investigating offshore export cable routing options and using geophysical data to inform micro-siting. Ongoing collaboration between NatureScot and the Developer will aim to develop strategies that minimise / prevent impacts to the Pobie Bank SAC as a result of the Offshore Proposed Development.

Initial feedback was also provided on the proposed approach to the EIAR for the Offshore Proposed Development, including the suggested scoping in and out of impacts. The Developer considered this feedback and adjustments have been made on the scope of the assessment, as reflected in Section 6.5.4 of this Offshore Scoping Report.

6.5 Baseline Environment

An understanding of the baseline marine and coastal processes which control the features, pathways and receptors within the study area, is presented in the following sections. Regional context is provided where appropriate and dependent on the scale of the processes discussed. This baseline understanding, as presented below, will be further developed following completion of Offshore Proposed Development specific surveys and updated in the following phases of the EIA process.

6.5.1 Offshore Array Areas

6.5.1.1 Bathymetry

Across the Array Areas, water depths range between, approximately, 110 m to 160 m LAT with depths showing no distinct trend across the Array Areas (EMODnet, 2023). There is no evidence of any sand banks, sand waves or mega ripples within the Array Areas.

6.5.1.2 Geology

The study area is located on the East Shetland Platform, west of the Viking Graben Basin (Platt *et al.*, 1998). The underlying geology consists of Devonian Old Red Sandstone near the surface, ranging from 5 to 20 m (Platt *et al.*, 1998; BGS, 1976). This geological formation is underlain by basement metamorphic rocks, which are exposed to the west of the Array Areas (Platt *et al.*, 1998; BGS, 1976).

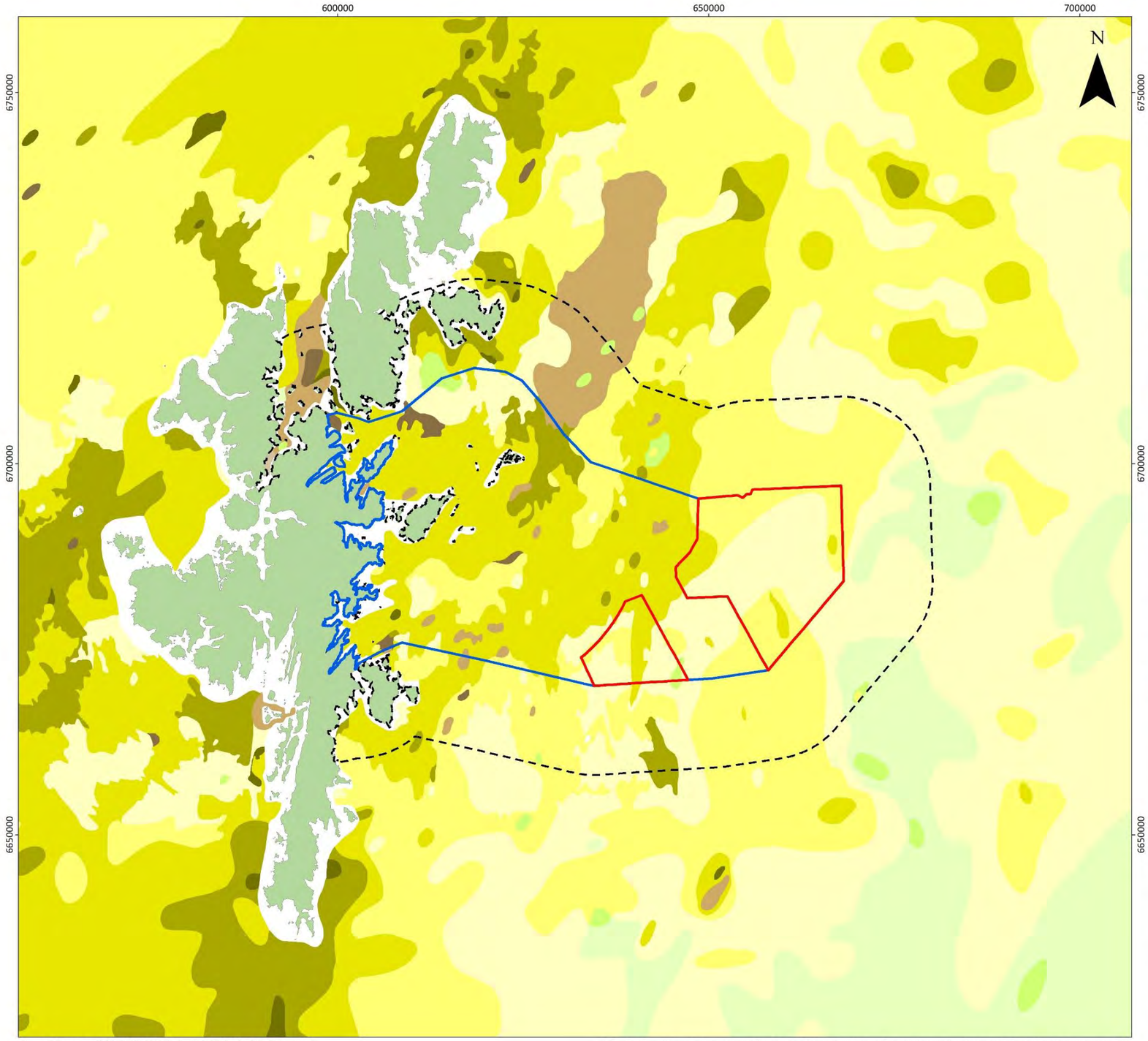
6.5.1.3 *Surficial Sediments*

Within the Array Areas, quaternary sediments are overlain by surficial sediments, predominantly composed of gravelly sands and sands, with occasional occurrences of sandy gravel, potentially attributed to glacial till (BGS, 2023; Figure 6.2).

Mud fractions are located outside the Array Areas within the Unst Basin and in localised patches to the south of the study area. Here, the proportion of muds is typically less than 10% with a maximum contribution of, approximately, 33% (BGS, 2023; Barne *et al.*, 1997). Muddy sand is more common in depths from 120 m to 160 m (DECC, 2004). Due to several different terrestrial and marine carbonate sources, combined with an energetic hydrodynamic regime, the sand around Shetland has a high carbonate content (DECC, 2004). A large sand zone has been observed between 100 and 120 m within the Array Areas (BGS, 2023; Figure 6.2.

6.5.1.4 *Sediment Transport*

Within the Array Areas, as is typical of the East Shetland Platform, sediment transport is under the control of highly energetic non-directional waves and surge events (Kenyon and Cooper, 2005; Figure 6.3). Water depths within the Array Areas are likely to limit the influence of the more frequent, less energetic waves upon the seabed.



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Surficial Seabed Sediments within the Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Zone of Influence

Seabed Sediments (Folk, 1954) (EMODnet)

- 1.1.1 Mud
- 1.1.2 (gravelly) Mud
- 1.2.1 sandy Mud
- 1.2.2 (gravelly) sandy Mud
- 1.3.1 muddy Sand
- 1.3.2 (gravelly) muddy Sand
- 2.1.1 Sand
- 2.1.2 (gravelly) Sand
- 3.1.1 gravelly Sand
- 3.2.1 sandy Gravel
- 3.3.1 Gravel
- 4.1.1 gravelly Mud
- 4.2.1 muddy Gravel
- 4.3.1 gravelly muddy Sand
- 4.4.1 muddy sandy Gravel
- 5. Rock and Boulders

Notes

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Coordinate System:
WGS 1984 UTM Zone 30N

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0 5 10 nm

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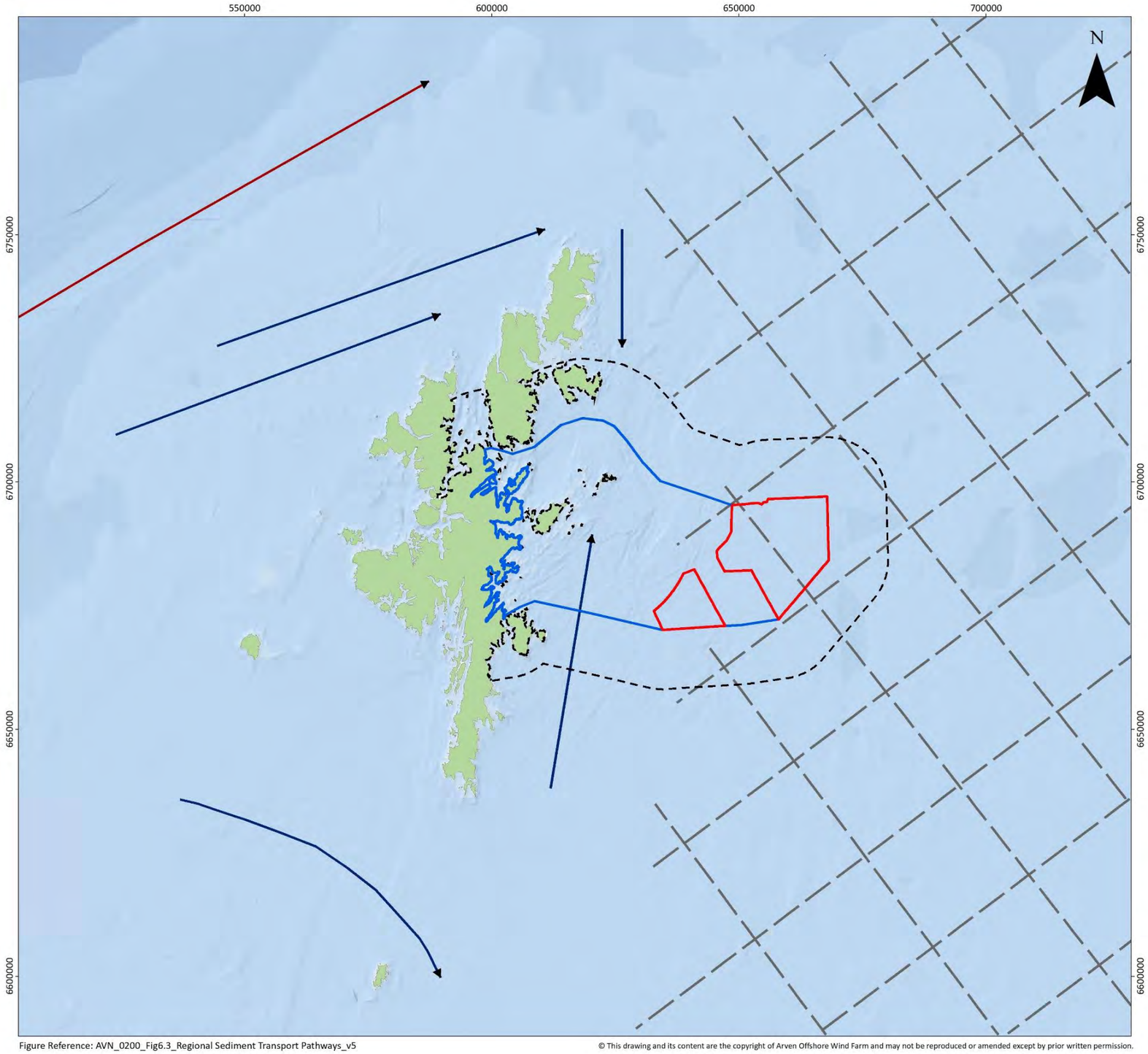
Figure 6.2

Figure Reference: AVN_0200_Fig6.2_Superficial Seabed Sediments_v5

Figure 6.2: Surficial Seabed Sediments within the Offshore Proposed Development (Folk, 1954)



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Regional Sediment Transport Pathways

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Zone of Influence

Sediment Transport Pathways (Kenyon and Cooper, 2005)

- Wave Dominant (Non-directional)
- Paths with Dominant Surge Influence
- Oceanic Current Transport

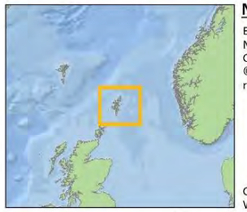

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Figure 6.3

Figure Reference: AVN_0200_Fig6.3_Regional Sediment Transport Pathways_v5

Figure 6.3: Regional Sediment Transport Pathways (Kenyon and Cooper, 2005)

6.5.1.5 Suspended Sediment

SPM provides an indication of turbidity and is highly variable according to the water depth and hydrodynamic processes (i.e., tide, current, and wave regimes). Whilst there are currently no data sources informing on the SPM levels within the Array Areas, due to the water depths and distances from land, it has been possible to infer these levels from nearby observations (Cefas, 2016). There is a northward trend of reducing SPM levels such that, 25 km to the south of the Array Areas, concentrations are less than 1 mg/l throughout the year (Cefas, 2016). For further detail on suspended sediments, the reader is referred to Chapter 7: Marine Water & Sediment Quality.

6.5.1.6 Hydrodynamics

6.5.1.6.1 Tides

The modelled mean spring and neap tidal ranges across the Array Areas are, approximately, 1.6 m and 0.7 m for the spring and neap tide, respectively (ABPmer *et al*.., 2023). Tidal currents are relatively weak in the Array Areas, with the mean tidal flows for spring and neap being, 0.34 m/s and 0.12 m/s, respectively (ABPmer *et al*.., 2023) (Figure 6.4). The tidal ellipse exhibits an elongated oval shape, primarily oriented in a north-south direction, extending over, approximately, 5 km, whilst spanning less than 1 km in an east-west direction thus demonstrating the predominant tidal flow to the north and south of the Array Areas, on the ebb and flood tides respectively.

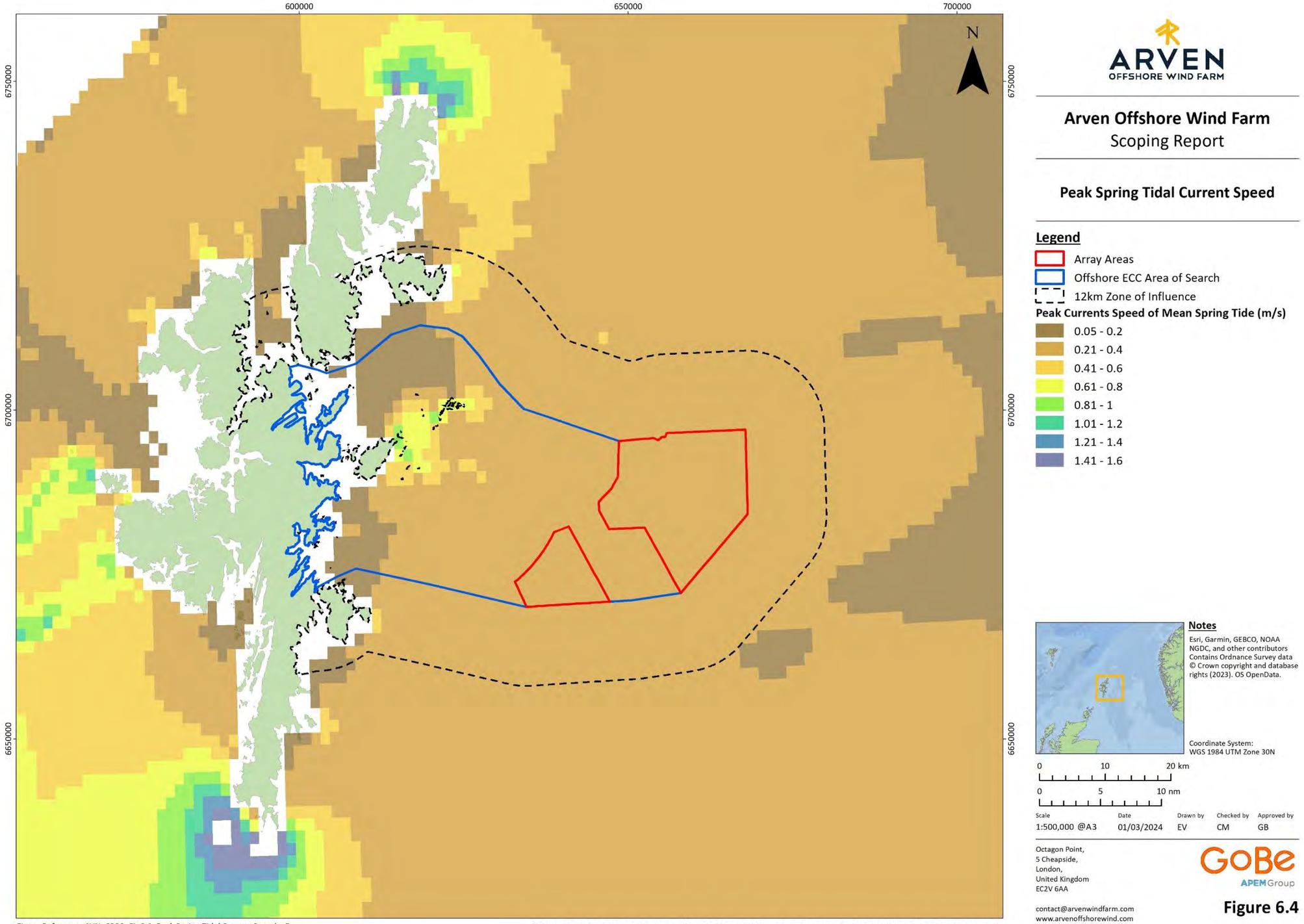


Figure 6.4: Peak Spring Tidal Current Speed

6.5.1.6.2 Non-tidal Influences

Superimposed upon regular tidal behaviours are various non-tidal influences, which mainly originate from meteorological effects. An example is surges, formed by rapid changes in atmospheric pressure causing the water levels to fluctuate considerably above or below the tidal level. This effect can be further impacted by the wind strength and direction. Moving low pressure systems and associated strong and persistent wind fields may generate strong positive surges, often referred to as a 'storm surge'.

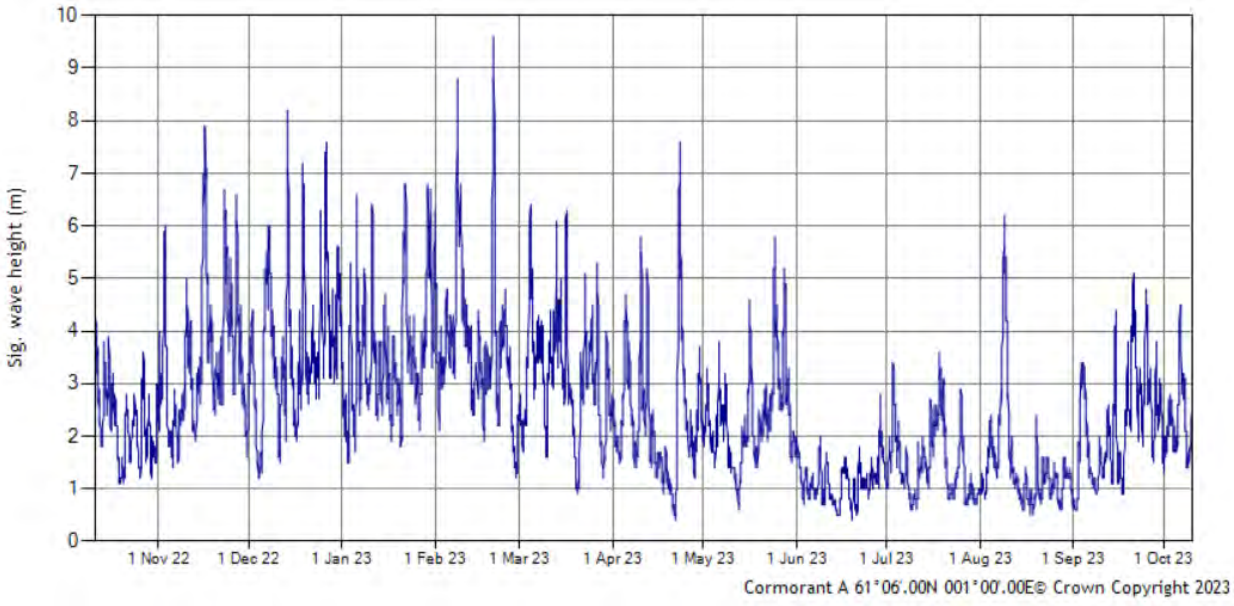
Storm surges may cause short-term modification of astronomically driven tidal currents. Under an extreme (one in a 50-year return period) storm surge, current speeds around Shetland have been modelled to be of the order of 80 cm/s (Flather *et al*., 1987).

6.5.1.6.3 Waves

Cormorant A is the closest observational wave buoy to the Array Areas and is located adjacent to an oil platform 105 km northeast from the Array Areas. Since October 2022, the wave buoy has recorded wave heights of up to 9.6 m (Cefas, 2018; Figure 6.5).

Modelled data indicates mean annual significant wave heights within the Array Areas of, approximately, 2.2 m, reaching up to 2.5 m to the eastern extent of the area (ABPmer, 2018; Figure 6.6). Within the Array Areas, the primary wave source is from the north, with a smaller proportion of waves originating from the south; few waves originate from the east or west directions (ABPmer, 2018).

Figure 6.5: Significant wave Height from the Cormorant A Wave Buoy



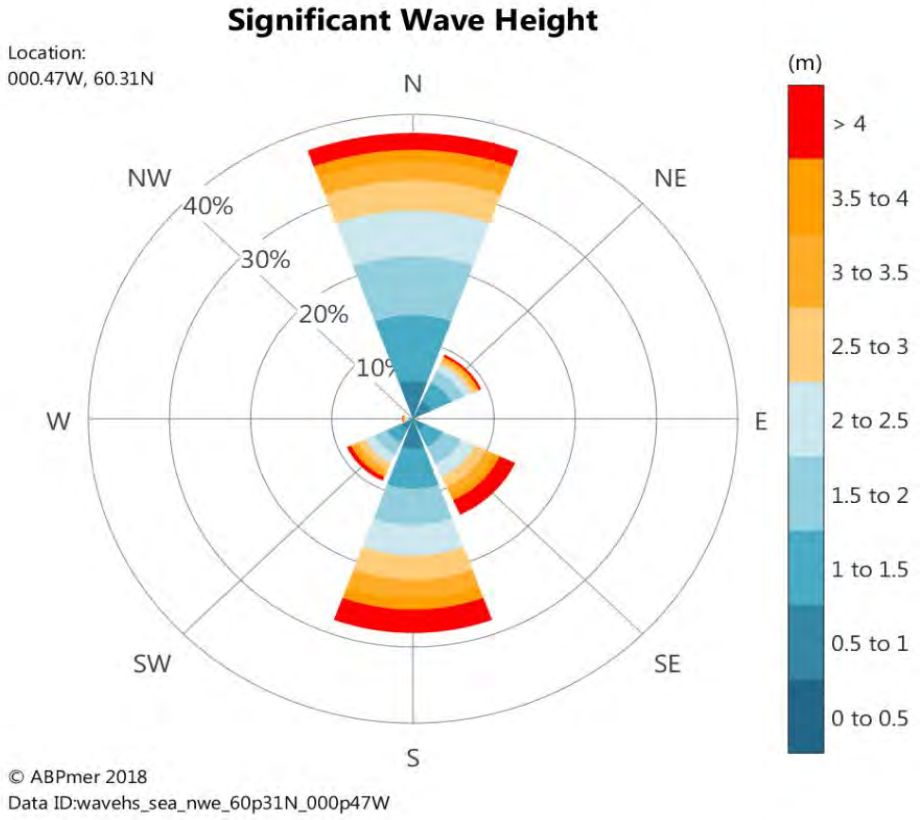


Figure 6.6: Significant Wave Height in the Array Area (ABPmer, 2018)

6.5.1.6.4 Frontal Zones and Stratification

Fronts play an important role in enabling the circulation and transport of nutrients and heat, and frequently reoccurring fronts are recognised as supporting enhanced biological activity (SECC, 2004). Frontal zones mark boundaries between water masses, including tidally mixed and stratified areas, and are numerous on the European continental shelf (BEIS, 2022b).

Stratification is a naturally occurring seasonal hydrodynamic feature relating to the distribution of sea water temperature and/or salinity. Vertical density stratification occurs across the study area during the summer months due to solar heat input at the surface. At the boundary between seasonally stratified water and permanently mixed conditions, frontal jets occur which are associated with density fronts (Marine Scotland, 2021).

Thermal fronts are present in Shetland in spring and are much stronger on the west coast. In the summer, strong thermal fronts are also present on the east coast, these can be observed through chlorophyll mapping (Miller *et al.*., 2014; Figure 6.7). As shown in Figure 6.7, a seasonal thermal front occurs immediately to the west of the Array Areas.

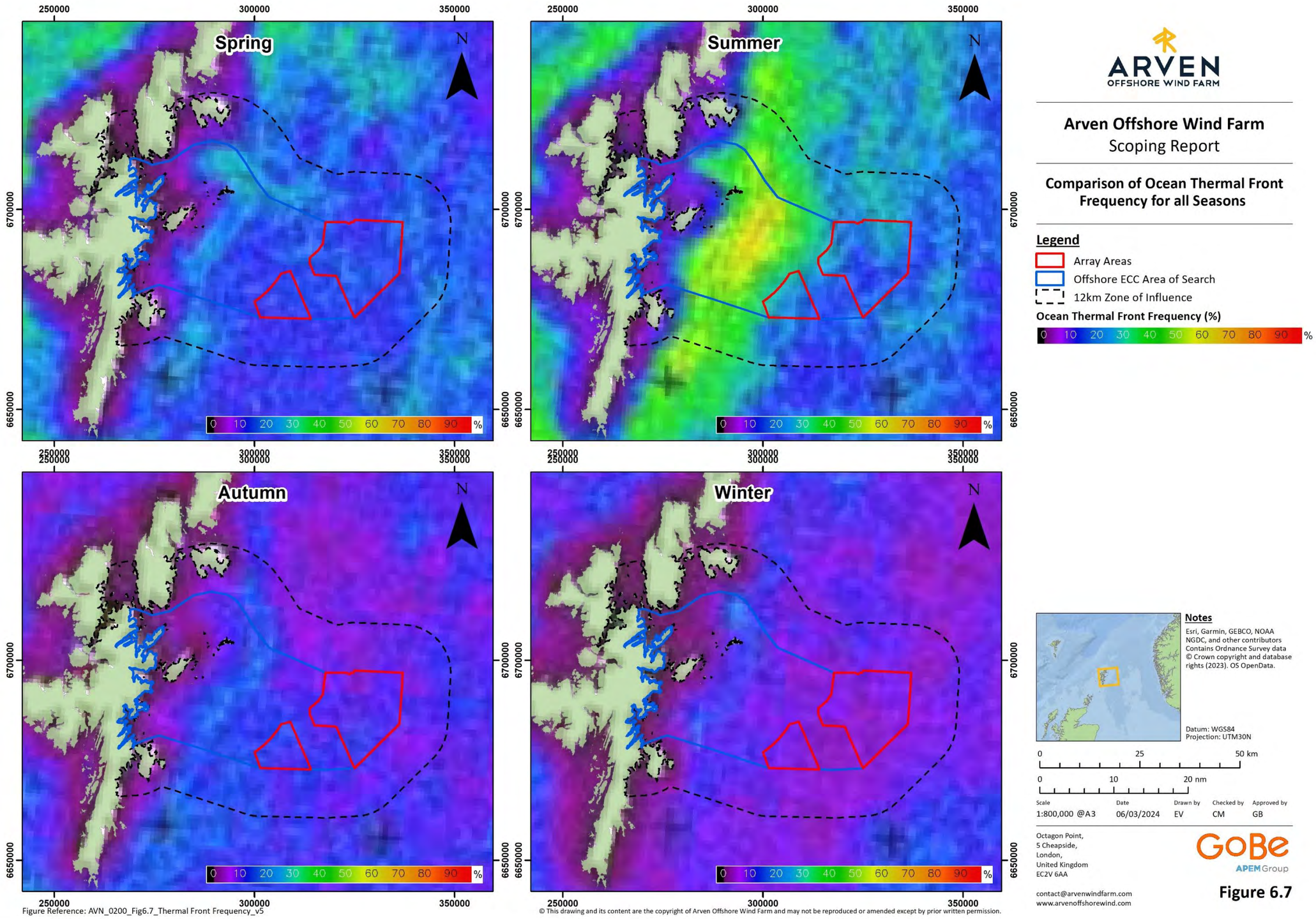


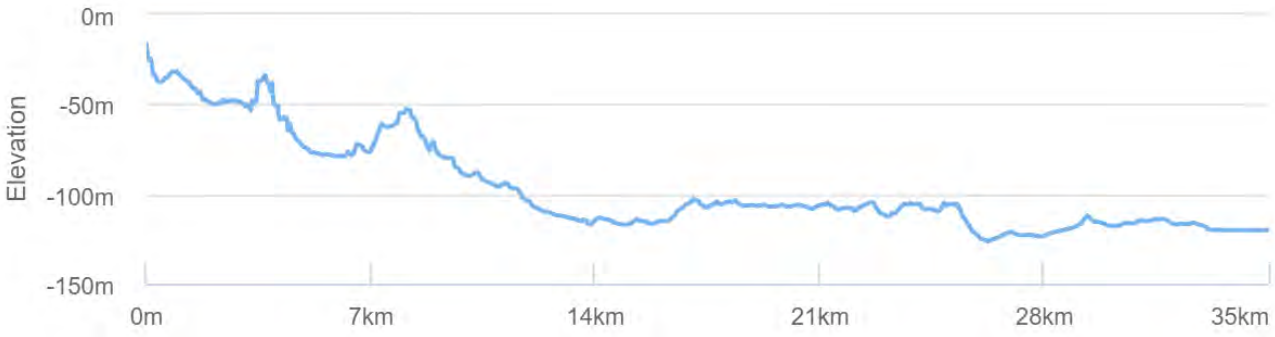
Figure 6.7: Seasonal comparison of Ocean Thermal Front Frequency, as percentage occurrence

6.5.2 Offshore ECC

6.5.2.1 Bathymetry

The OfECC Area of Search covers an area of 1,200 km^2 and includes the coastline between, approximately, 1 km north of Lerwick and the southeast of Yell Sound. The OfECC transverses through the West Unst Basin, reaching depths of between 60 to 140 m LAT (Platt *et al*., 1998; BGS, 2023; EMODnet, 2023). Formed during the Permo-Triassic period, this basin originated from a fault complex between Pobie Bank and Shetland (John and Andrews, 1985). A bathymetric profile from west to east, starting from Mainland, Shetland and ending at Arven South Offshore Wind (avoiding the West Unst Basin and Pobie Bank at 27 km offshore), is shown in Figure 6.8 and can be used to illustrate the depth range within the OfECC (EMODnet, 2023).

Figure 6.8: Bathymetric profile along the middle of the Offshore ECC Study Area (EMODnet, 2023)



Notable seabed features within the OfECC study area, as shown on Figure 6.1, include:

- The Pobie Bank, is a rocky bank seabed feature located between 25 and 30 km east of Shetland, orientated parallel to the West Unst Basin. Water depths over this seabed feature range from, approximately, 60 to 110 m (JNCC, 2020). The bank is, approximately, 70 km in length and up to 20 km wide (DECC, 2004). Surficial seabed sediments are in pockets between the bedrock outcrops and Annex I reef and comprise sand and gravelly sand, with patches of sandy gravel located on the northern and eastern margins of the bank and slightly gravelly, muddy sand on the southern and western margins and southern bank crest (DECC, 2004).
- The West Unst Basin is located parallel to Pobie Bank. At the point where the OfECC study area crosses the basin, its width is 5.5 km from which it narrows in a southerly direction to, approximately, 12 km to the south where the feature terminates (EMODnet, 2023). The basin at its deepest is 140 m, with steep sides on its westerly side (EMODnet, 2023).

6.5.2.2 Geology

The OfECC is primarily located on Old Red Sandstone, closer to the Array Areas, with older basement metamorphic geology closer to landfall (BGS, 2023). The line of contact between the older basement metamorphic rocks and the Old Red Sandstone runs north to east with the northern portion containing the metamorphic rocks, this contact makes landfall, approximately, 1 km north of Lerwick (Platt *et al*., 1998; BGS, 2023).

Shetland is divided by several north to south running geological faults, all thought to be an extension of the Great Glen Fault which splits the Highlands of Scotland (Mykura, 1976). The Nesting fault is present within the OfECC in select areas such as Wabster Voe, Cat First, Dury Voes and Swining Voe (Mykura, 1976).

There are two areas of thick quaternary deposits south of Fetlar with a thickness of 30 to 50 m and one in the West Unst Basin (Platt *et al.*., 1998; BGS, 2023). In the thinnest parts, these Quaternary sediments typically consist of undifferentiated sediments, diamict, and soft muds (BGS, 2023).

6.5.2.3 Surficial Sediments

Gravel mostly occurs in the nearshore coastal areas, coinciding with strong wave-driven near-bottom currents (DECC, 2004). Gravelly sand and sandy gravel occur extensively to the east of Shetland (DECC, 2004; Figure 6.2:).

Mud fractions, typically well below 10%, and in very rare cases constituting even a third of the sediments, can be found in the Unst Basin and in patches to the south of the study area (BGS, 2023; Barne *et al.*., 1997; Figure 6.2:). Muddy sand is more common in depths between 120 and 160 m (DECC, 2004).

6.5.2.4 Sediment Transport

Nearshore Shetland has a very complex system of sediment transport with various cells and sub cells identified within Shoreline Management Plans, many of its enclosed deeply indented bays would classify as a cell due to their independence from other cells (Baine *et al.*., 1996; DECC, 2004). As such, the Island's sediment cells have been simplified to sub cell 11a – Shetland East and sub cell 11b – Shetland West (Baine *et al.*, 1996; DECC, 2004). Further offshore sediment transport to the east of Shetland is to the south and southeast (DECC, 2004).

As the tidal currents are relatively benign (Figure 6.4), sediment transport is typically under the control of wave and storm-surge events (Kenyon and Cooper, 2005). Sediment transport under storm surge currents, occurs to the south and north (Kenyon and Cooper, 2005; Figure 6.3).

Deep water is located close to the shoreline and given the severity of the wave climate the coastline is exposed to high energy conditions, with sediment typically moved offshore under storm events (Baine *et al*., 1996).

6.5.2.5 Suspended Sediment

As presented in section 6.5.1.5, there are no publicly available data sources which provide information regarding suspended sediments along the OfECC. Based on the northwards decreasing trend of SPM shown in Cefas (2016), it is assumed that levels are less than 1 mg/l in the offshore areas of the OfECC. Towards the shore, where water depths reduce, tidal flows increase and wave effects are more regularly experienced on the seabed, it is expected that higher SPM levels, particularly during the winter period will occur in shallower areas.

6.5.2.6 Hydrodynamics

This section provides an overview of the influences of tidal, non-tidal, and wave processes within the OfECC.

6.5.2.6.1 Tides

Generally, the tidal flow within the OfECC is towards the south on the flood tide and northwards on the ebb (Baine *et al.*., 1996). Tidal range within the OfECC is 1.87 m and 0.83 m, for spring and neaps, respectively (ABPmer *et al*., 2023). Closer to land, current speeds are greatest at the north and the south of Shetland, with

peak spring flow reaching 1.70 m/s and 1.40 m/s off the south and north landmasses, respectively. The greatest flow speeds within the OfECC occur off the east coast of Whalsay where a mean peak spring flow of 0.91 m/s is predicted to occur (ABPmer *et al.*, 2023; Figure 6.4).

6.5.2.6.2 Non-tidal Influences

As explained in Section 6.5.1.6.2, normal tidal influences are affected by a range of nontidal influences from meteorological effects, such as storm surges which have the potential to increase the current speeds to 80 cm/s (Flather *et al.*, 1987).

6.5.2.7 Waves

The closer the proximity to shore in the OfECC, the greater the proportion of waves that originate from the south (Figure 6.9) although there is a large proportion also originating from the north (ABPmer, 2018). The area is typically considered to be energetic between October and March, with 20 to 30% of wave heights regularly exceeding 4 m within the study area (DECC, 2004).

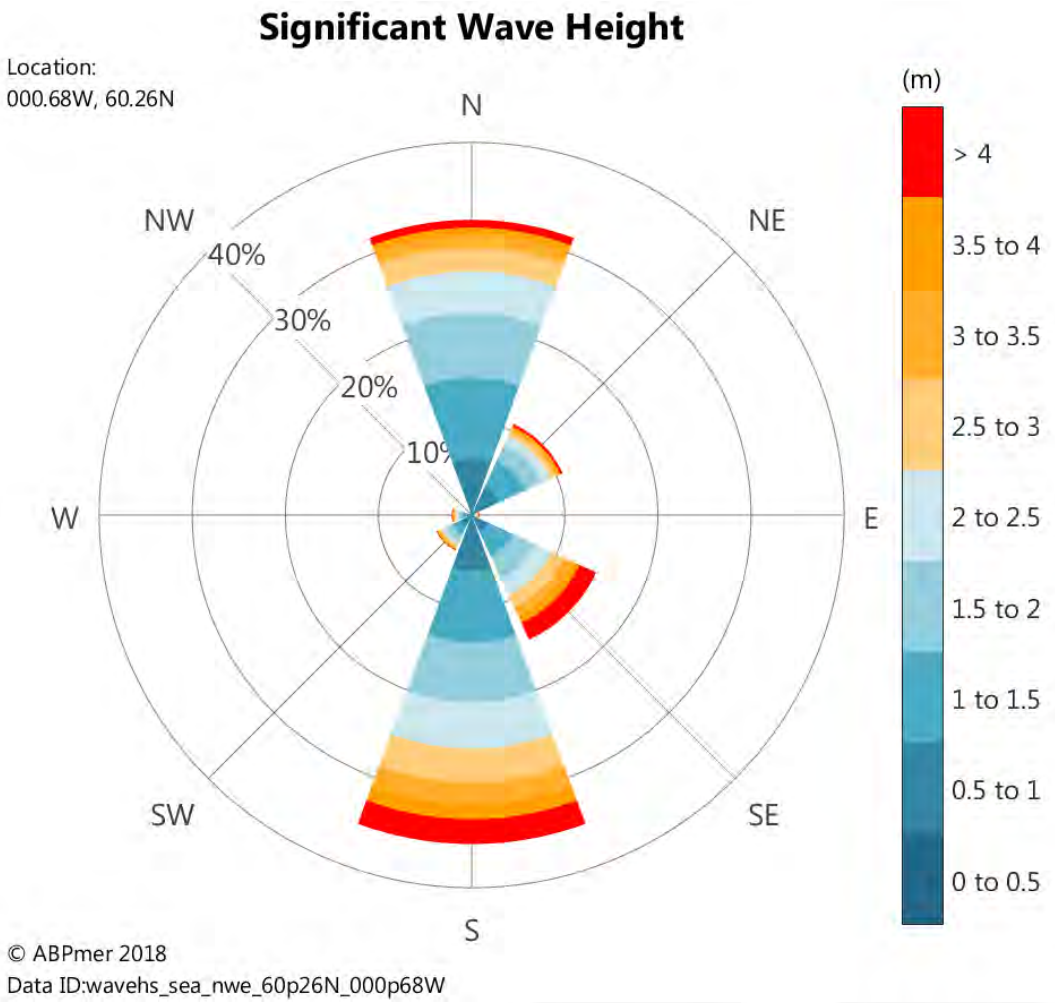


Figure 6.9: Significant Wave Height in the Offshore ECC (ABPmer, 2018)

6.5.2.7.1 Frontal Zones and Stratification

The OfECC coincides with a frontal area which develops during the summer months (Section 6.5.1.6.4; Figure 6.7).

6.5.2.8 Coastal Form

The majority of the coastal extent of the OfECC study area is situated along eastern Mainland, Shetland characterised by an intricate network of voes[2]. These voes exhibit a prevailing north to northeast orientation (Barn *et al.*, 1997). The coastal stretch primarily comprises Dalradian metamorphic rock formations on its exterior cliffs (Barnes *et al*., 1997). Evident features within the coastal OfECC study area indicate a submerged coastline, notably identified by offshore gravel deposits overlaying historic peat deposits, indicating a significant historical rise in sea levels (Barne *et al.*, 1997).

The coastal topography of the area is notably diverse, encompassing sheltered voes, rocky coastlines, and exposed cliffs (SMPP, 2021).

Most of the landfall area is classified as '*Potentially Non-Vulnerable Area in Shetland Local Plan District*' (Sepa, 2021) with only three hard defences located along the coastline, an example being at Vidlin (Sepa, 2021; Centre of Expertise for Waters, 2021). The coastline is predominately defined as '*non-erodible*', with localised areas of erodible shoreline present (Dynamic Coast, 2021).

6.5.2.9 Future changes

A consideration of the future baseline, including the associated variation, is provided in the context of the operating lifetime of the Offshore Proposed Development. For the current purposes of this Offshore Scoping Report, the Representative Concentration Pathway (RCP) 8.5 (high emissions) scenario (Palmer *et al.*., 2018) has been applied. The UK is also affected by isostatic readjustment, a regional change in land surface elevation following the removal of the weight of the British-Irish Ice Sheet. Due to this post-glacial uplift, the sea level in this region is estimated to change by, approximately, -0.6 mm to -0.9 mm/year (Palmer *et al.*., 2018), although this is outpaced by rates of global sea level rise (BEIS, 2022a). The NASA – Sea Level Projection Tool models a sea level rise following a RCP 8.5 (high emissions) scenario of 0.20 to 0.21 m by 2050 within the Offshore Proposed Development (NASA, 2021).

Numerous studies have investigated the potential future changes in the wave climate, using a range of numerical modelling assessments based upon different future scenarios i.e. RCP 8.5. An increase in wave heights (in addition to wind speeds) has been predicted for the Northeast Atlantic (McDonald, 2010; Bonaduce *et al*., 2019). Further, it has been hypothesised that the predicted wave height increases for areas north of the Scottish mainland may result from Artic sea ice retreat, due to global warming, which in turn allows for a greater fetch length (Bricheno and Wolf, 2018).

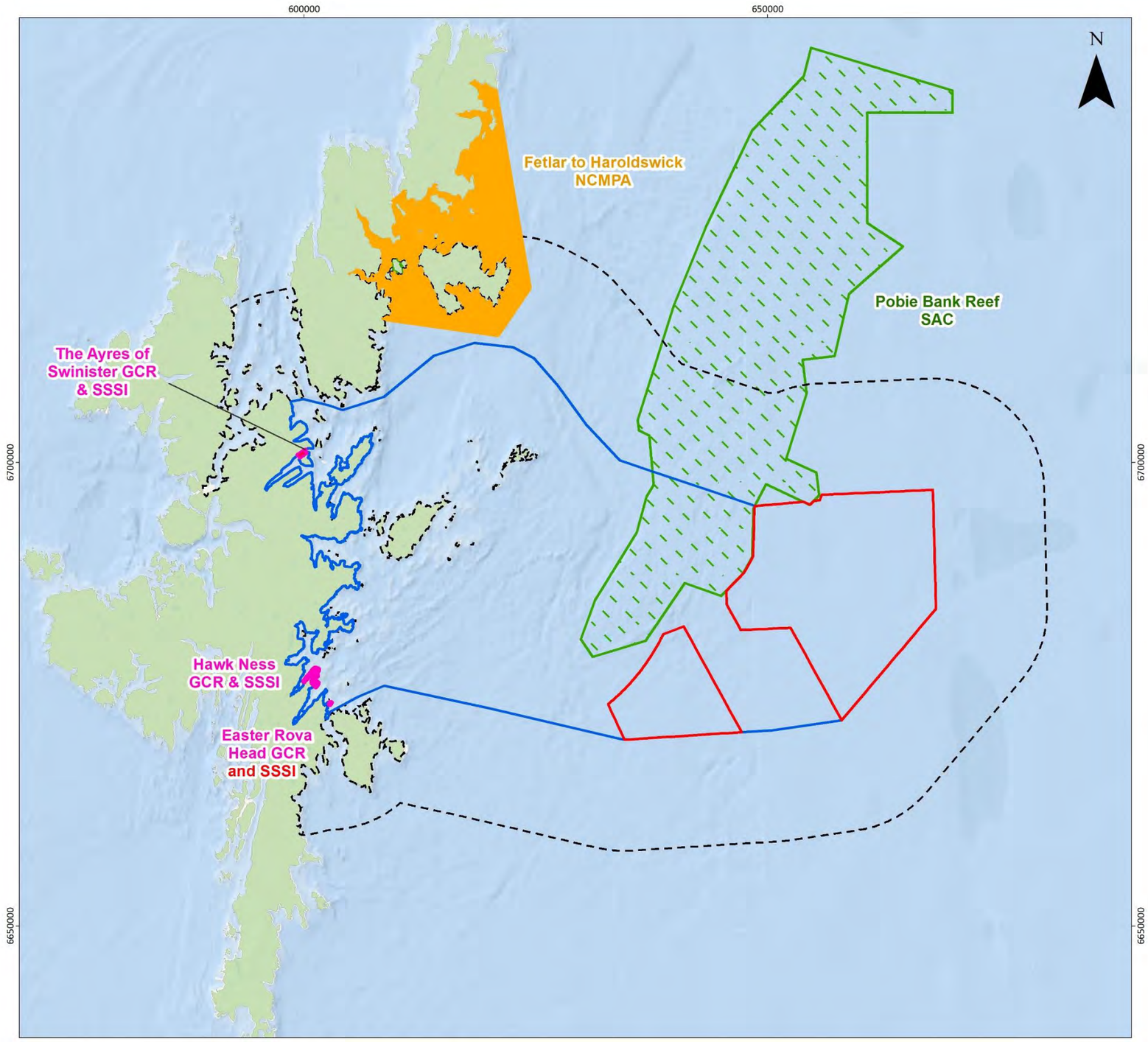
[2] Deep and narrow estuarine inlets akin to fjords but devoid of glacial till (Barne *et al*., 1997)

6.5.3 Designated Sites

Designated sites within the study area, of relevance to this technical topic, are listed in Table 6.2 and shown in Figure 6.10. The Offshore Proposed Development is likely to be refined over time, which will lead to the refinement of the list of relevant designated sites.

Table 6.2: Designated sites of relevance to Marine Geology, Oceanography and Physical Processes

Site	Protected features of relevance to Marine Geology, Oceanography and Physical Processes	Information
Pobie Bank SAC	Reefs	Approximately 70 km long and 21 km wide and lies across the 12 nm territorial waters boundary (JNCC, 2020). The reef supports extensive communities of bryozoans and sponges (JNCC, 2020).
Fetlar to Haroldswick NCMPA	Sublittoral sediment, circalittoral sand and coarse sediment communities.	Located around both the island of Fetlar and the east coasts of Unst and Yell.
Easter Rova Head Geological Conservation Review (GCR & SSSI)	Very coarse-grained Mid-Devonian conglomerates Sea cliffs and rocky foreshore around the Easter Rova Head	Located 4 km north of Lerwick on the east coast of Shetland, this is a lithified example of an alluvial environment
Hawk Ness (GCR & SSSI)	Metasedimentary sequence in the Dalradian successions in Scotland (Flinn *et al*., 2013).	A well-exposed representation of a Dalradian metasedimentary sequence, (Flinn *et al*., 2013)
The Ayres of Swinister (GCR & SSSI)	Gravel spit and tidal basin (Hansom, 2002).	Two gravel spits connecting the northeast Mainland, Shetland to I Ness, with a tidal basin named “the Houb”, forming between them (Hansom, 2002).



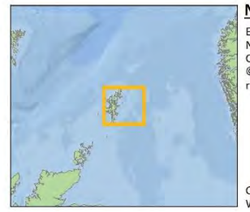
ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

Designated Sites of Relevance to Marine and Coastal Processes within the Study Area

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Zone of Influence
- Special Area of Conservation
- Sites of Special Scientific Interest
- Marine Protected Areas
- Geological Conservation Review Sites



Notes

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System: WGS 1984 UTM Zone 30N

0 10 20 km
0 2 4 6 8 nm

Scale	Date	Drawn by	Checked by	Approved by
1:400,000 @A3	07/05/2024	EV	CM	GB

Octagon Point,
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Figure 6.10

Figure Reference: AVN_0200_Fig6.10_Designated Sites_v8

Figure 6.10: Designated Sites of relevance to Marine Geology, Oceanography and Physical Processes

6.5.4 Summary of Key Issues

The primary receptors for marine geology, oceanography and physical processes within the study area are identified as follows:

- Designated sites, such as Pobie Bank SAC (Annex I reef (Table 6.2)); and
- Seabed features i.e. the West Unst Basin.

6.6 Embedded Mitigation

As part of the Offshore Proposed Development design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental receptors. These are presented below and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

As a result of the commitment to implement these measures, and to align the Offshore Proposed Development with various standard sectoral practices and procedures, the Embedded Mitigations are considered inherently part of the design of the Offshore Proposed Development and have therefore been included in the assessment.

The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon marine and coastal processes and will be consulted upon with Statutory Consultees throughout the EIA process.

- C-1: Development of and adherence to Cable Plan (CaP). The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
- C-2: Development of and adherence to a Development Specification and Layout Plan (DSLP). The DSLP will confirm the layout and design parameters of the Offshore Proposed Development.
- C-4: Development of and adherence to a Construction Method Statement (CMS). The CMS will confirm construction methods and the roles and responsibilities of parties engaged in construction. It will detail any construction-related mitigation measures.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Offshore Proposed Development .
- C-17: Development of and adherence to an Operation and Maintenance Programme (OMP). The OMP will describe O&M activities and provide an indicative schedule for the undertaking of these.
- C-20: Scour protection will be deployed where there is the potential for scour to develop around infrastructure (foundations and cables).
- C-29: Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP.
- C-32: Suitable implementation and monitoring of cable protection (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible), as detailed within the CaP.

6.7 Scoping of Impacts

An initial assessment of the likelihood of effects on marine geology, oceanography and physical processes due to Offshore Proposed Development activities for the scoping stage of the EIA process, is presented in Table 6.3 and Table 6.4.

Marine geology, oceanography and physical processes are typically best described as pathways rather than receptors. Consequently, outputs from the assessments will be considered upon receptors in the following EIAR chapters:

- Chapter 7: Marine Water & Sediment Quality and;
- Chapter 8: Benthic Subtidal and Intertidal Ecology.

The scoping of indirect impacts from the identified marine geology, oceanography and physical processes pathways will also be assessed within the relevant topics.

The marine geology, oceanography and physical processes features that are considered as potential receptors will be guided by tidal excursion and will inherently include the following features:

- The adjacent coastline;
- Nationally or internationally designated sites with interest features below MHWS (seabed/ sedimentary/ geological interest features); and
- Seabed features i.e., the West Unst Basin and isolated areas of mud fractions indicated in quaternary deposits.

Table 6.3: Impacts scoped into the assessment of Marine Geology, Oceanography and Physical Processes

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Construction and Decommissioning			
Increases in suspended sediment concentrations (SSCs) and changes to seabed levels	Temporary elevations in SSCs due to construction (i.e., cable installation) activities. This could in turn result in changes to the underlying seabed/coastal bed levels, through deposition of the suspended material and changes to the surficial sediment type. Increases in SSC and associated deposition may have indirect, adverse impacts upon other receptor groups including Benthic, Subtidal and Intertidal Ecology (Chapter 8), Fish Ecology (Chapter 9), Marine Mammals (Chapter 10) and Commercial Fisheries (Chapter 13).	The assessment of potential changes to SSC and bed levels caused by construction activities will primarily be undertaken using sediment plume models. Results will be provided for representative hydrodynamic conditions and sediment types experienced at the site. The realistic worst case (in terms of plume extent, concentration and deposition) will be assessed. Available baseline information and site-specific surveys will provide the data inputs for this assessment.	C-1 (CaP); C-4 (CMS), C-14 (DP), C-29 (Cable burial - CaP), C-32 (Cable protection - CaP)
Potential impacts to seabed morphology	Construction activities such as seabed preparation, sand wave levelling and cable trenching have the potential to directly disturb the seabed morphology. This disturbance may have adverse impacts on other receptor groups including Benthic, Subtidal and Intertidal Ecology (Chapter 8), Fish and Ecology (Chapter 9), and Commercial Fisheries (Chapter 13). Decommissioning activities relating to the removal of infrastructure (if required) have the potential to directly disturb the local seabed morphology.	The potential for disturbance to the seabed morphology will be assessed based on a consideration of sediment transport potential, the dimensions of any seabed features present and the available evidence base.	C-1 (CaP); C-4 (CMS), C-14 (DP), C-29 (Cable burial - CaP), C-32 (Cable protection - CaP)

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Modifications to littoral transport and coastal behaviour (erosion), including at Landfall	Where the Offshore Export Cable makes landfall, it must transition through the intertidal areas and coastal zones. The methods available for installing/ removing cables in such environments may physically disturb or disrupt the coastal morphology to differing degrees depending on the construction methods employed and any structures installed. At the time of construction, any disturbance is likely to be localised to the landfall site.	The short-term physical impact of export cable installation at the landfall will be assessed using available relevant coastal processes data. The assessment will consider outputs from sediment plume modelling, in addition to observational evidence from other suitably analogous projects. The available baseline information and site-specific surveys will provide the data inputs for this assessment.	C-1 (CaP); C-4 (CMS), C-14 (DP), C-29 (Cable burial - CaP), C-32 (Cable protection - CaP)
Operation and Maintenance			
Seabed Scouring	The wind farm infrastructure has the potential to cause localised seabed scouring, resulting in bathymetric changes and localised alterations to sediment transport patterns. This is likely to occur both around foundations for OSP(s) as well as around anchors and clump weights that may be part of floating WTG infrastructure.	The assessment will be informed by the evidence base and project specific surveys.	C-1 (CaP), C-17 (OMP), C-20 (Scour protection), C-29 (Cable burial - CaP), C-32

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Modifications to the tidal regime, and associated impacts to morphological features.	The interaction between the planned infrastructure, for example the WTGs, cable protection or cable crossings, and the baseline metocean regime tides may result in localised changes to tidal current speeds and turbulence. These changes may, in turn, impact on adjacent physical features, both offshore and along the coast. The impacts upon the current regime which may result from the presence of the project infrastructure will be greatly reduced relative to any resulting from the presence of fixed offshore structures, due to the reduced blockage within the water column. Changes to the tidal regime from the presence of offshore structures have been shown to be localised and not significant in EIA terms (Repsol and EDP Renewables, 2013; Moray Offshore Renewables Limited (MORL), 2014). This potential impact has been scoped in in response to NatureScot comments following the Scoping Workshop.	Persistent changes to tidal currents may have a net influence over time on patterns of sediment transport (rates and directions), with consequential impacts to seabed and coastal morphology. The importance of small changes to instantaneous current parameters will be evaluated in the context of the wide range of natural temporal variations and longer-term trends. Consideration will also be afforded to sufficiently analogous wind farm developments and metocean conditions, with consideration of the environmental setting and the foundation type, number and layout.	C-2 (DSLP), C-17 (OMP)
Potential impacts to seabed morphology	The Offshore Proposed Development will be a floating OWF. There is the potential for the introduction of localised seabed abrasion associated with wind farm infrastructure that moves, for example anchor or mooring chains, under the influence of waves, currents, and movement of the turbines (Maxwell *et al*., 2022). This could result in localised change to seabed morphology. In addition, the OfECC may cross parts of Pobie Bank and the West Unst Basin.	The potential for disturbance to the seabed morphology will be assessed based on a consideration of sediment transport potential, the dimensions of any seabed features present and the available evidence base.	C-1 (CaP), C-17 (OMP), C-20 (Scour protection), C-29 (Cable burial - CaP), C-32 (Cable protection - CaP)

Table 6.4: Impacts scoped out of the assessment of Marine Geology, Oceanography and Physical Processes

Impact	Justification
Construction and Decommissioning	
Construction impacts on the wave and tidal regime	The presence of construction vessels and other construction infrastructure will only impact the wave and tidal regimes in the immediate vicinity. Further, the vessels/ infrastructure will only be in place for the duration of the specific construction works (days to weeks) providing a temporary (short-term) impact upon the wave and tidal regimes. As such, these impacts are scoped out from further assessment
Impacts on seabed morphology due to indentations on the seabed from installation vessels	Any vessels which rely upon jack-up legs or anchors to remain in position during construction works have the potential to impact the seabed on a scale proportional to the dimensions and drag (if applicable) of the item placed on the seabed. The localised spatial scale and temporary nature of the impact is such that over time any indentation will likely infill. As such, these impacts are scoped out from further assessment
Operation and Maintenance	
Modifications to the wave regime, and associated impacts to morphological features	The interaction between the planned infrastructure, for example the WTGs, cable protection or cable crossings, and the baseline metocean regime, may result in localised changes to wave energy and turbulence. These changes may, in turn, impact on adjacent physical features, both offshore and along the coast. Impact assessments for previous offshore wind developments, based on fixed turbine foundations, have demonstrated that there are no significant impacts on the wave regime (Repsol and EDP Renewables, 2013; MORL, 2014). Due to the distance offshore (circa 30 km at its closest point) and water depths (110 m to 160 m), any changes to the wave regime are considered unlikely to significantly impact adjacent seabed features or the coast and are therefore scoped out of further assessment

Impact	Justification
Modifications to stratification and frontal features	The presence of array infrastructure may result in the generation of turbulent wakes localised to the structures (Dorrell *et al*., 2022; ABPmer, 2011) which in turn may result in changes to localised mixing processes and therefore have the potential to de-stabilise water column stratification. Summer stratification occurs to the west of the Array Areas and considering the predominant north-south direction of the tidal axis, it is considered that should any turbulent wakes extend outwith the Array Areas this will also occur to the north and south. The wake length is dependent upon the current speed with greater lengths associated with greater current speeds and as such, due to the low tidal flows, it is expected that any wakes will remain localised to the array structures. The wakes will disperse with increased distance from the infrastructure and will not result in the destabilisation of the stratification to the west of the Array Areas and is therefore scoped out of further assessment

6.8 Potential Cumulative Impacts

Chapter 4: EIA Methodology details how the potential cumulative impacts will be assessed through a CIA. For marine geology, oceanography and physical processes, cumulative interactions may occur with other planned renewable developments as well as other activities, for example aggregate extraction, in the study area.

Impacts that are scoped into the assessment for the Offshore Proposed Development alone are generally spatially restricted to being within proximity to the Array Areas and OfECC. However, certain potential impacts, such as an increase in SSC, have the potential to be observed over a wider area. Potential cumulative impacts on marine geology, oceanography and physical process receptors will be guided by tidal excursions, to be further quantified using Offshore Proposed Development specific numerical modelling.

The CIA for marine geology, oceanography and physical processes will consider the maximum adverse design scenario for the Offshore Proposed Development and other plans and activities in line with the methodology outlined in Chapter 4: EIA Methodology.

6.9 Potential Transboundary Effects

The process by which potential transboundary impacts will be assessed is described in Chapter 4: EIA Methodology. There are no transboundary impacts on the marine geology, oceanography and physical process pathways expected resulting from the construction, O&M, or decommissioning activities associated with the Offshore Proposed Development. Any predicted impacts on these pathways are likely to be highly localised (e.g., remain within the study area), and will not affect the marine environment beyond UK waters. Therefore, it is proposed for transboundary impacts regarding marine geology, oceanography and physical processes to be scoped out of the subsequent EIA.

6.10 Proposed Approach to EIA

6.10.1 Relevant Guidance

In addition to the general approach and guidance outlined in Chapter 4: EIA Methodology, the assessment of marine geology, oceanography and physical processes will also comply with the following guidance documents where they are specific to this topic:

- EIA for offshore renewable energy projects (BSI, 2015);
- Coastal Process Modelling for Offshore Wind Farm EIA; Best Practice Guide (Lambkin *et al*.., 2009);
- Guidelines in the use of metocean data through the lifecycle of a marine renewable development (Cooper *et al..,* 2008);
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Cefas, 2011);
- Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications (MS-LOT, 2018);
- National Resources Wales (NRW) Monitoring Evidence Report No: 243 Guidance on Best Practice for Marine and Coastal Physical Processes Baseline Survey and Monitoring Requirements to inform EIA of Major Development Projects (Brooks *et al*.., 2018);

- Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry. Department for Business Enterprise and Regulatory Reform (BERR) in association with Defra (BERR, 2008);
- Offshore Windfarms: Guidance note for EIA in Respect of Food and Environmental Protection Act 1985 and CPA 1949 requirements (Cefas, 2004);
- Review of environmental data associated with post-consent monitoring of licence conditions of offshore wind farms. Marine Management Organisation (MMO) Project No: 1031 (Fugro-Emu, 2014);
- Offshore wind cabling: ten years' experience and recommendations (Natural England, 2018);
- Best Practice Advice for Evidence and Data Standards for offshore renewables projects (Natural England, 2022);
- Further review of sediment monitoring data (Collaborative Offshore Windfarm Research Into the Environment (COWRIE) ScourSed-09) (ABPmer *et al*.., 2010);
- Review of Round 1 Sediment process monitoring data – lessons learnt (Sed01) (ABPmer *et al*.., 2007);
- Dynamics of scour pits and Scour Protection – Synthesis report and recommendations (Sed02) (HR Wallingford *et al*.., 2007); and
- Potential Effects of offshore wind developments on coastal processes (ABPmer and METOC, 2002)

6.10.2 Additional Data Sources at EIA

A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. Offshore Proposed Development specific survey outputs will be used to enhance the understanding of the baseline conditions. These may include metocean surveys, further benthic ecology survey within a refined OfECC, and acquisition of additional JNCC survey data relevant to Pobie Bank SAC (Table 6.1).

A geophysical survey campaign within the Array Areas or along the OfECC is not currently planned to inform EIA, reflecting the availability of existing seabed survey data (geophysical, drop-down camera) within Pobie Bank Reef SAC to inform assessment. A geophysical survey campaign will be undertaken post-consent for the Array Area and refined OfECC to further inform the final design of the Offshore Proposed Development.

6.10.3 Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report.

The study area will be as currently outlined, with further refinement based upon tidal excursions and specifically sediment plume pathways to allow a definition of the ZoI, as well as to focus on the final OfECC. The scope of the marine geology, oceanography and physical processes assessment is to characterise and understand the marine and coastal processes present within the Offshore Proposed Development area, particularly with respect to the metocean regime and associated sediment transport processes. These will be used to inform other topic specific assessments, for example Benthic, Subtidal and Intertidal Ecology and Fish and Ecology.

The marine geology, oceanography and physical processes assessment will consider the magnitude and duration of the impact, the reversibility of the impact and the timing and frequency of the activity. An assessment of the potential impacts of the Offshore Proposed Development will be undertaken through application of the evidence base and numerical assessments, as appropriate. The significance of any changes will be evaluated against the likely naturally occurring variability in, or long-term changes to, the marine

physical environment within the Offshore Proposed Development lifetime due to natural cycles, for example storm events, and/or climate change.

Consultation will be undertaken at pivotal points throughout the EIA process to ensure that the approach, including the application of the evidence-base alongside numerical modelling (for the assessment of seabed sediment disturbance from construction activities), satisfies the requirements of both stakeholders and regulators.

6.11 Scoping Questions

The following scoping questions refer to the marine geology, oceanography and physical processes chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those existing and additional data sources listed in Sections 6.3 and 6.10.2, being used to inform the Offshore EIA?
- Do you agree with the proposed marine geology, oceanography and physical processes study area?
- Do you agree that all the marine geology, oceanography and physical processes pathways and receptors have been identified?
- Do you agree with the scoping in and out of impacts related to marine geology, oceanography and physical processes?
- Do you agree on the suitability of the embedded mitigation measures proposed for marine geology, oceanography and physical processes?
- Do you agree with the proposed assessment methodology, related to marine geology, oceanography and physical processes?
- Do you agree that, as stated in Table 6.3, numerical modelling will only be applied to assess seabed sediment disturbance from construction activities?
- Do you agree that the assessment can be undertaken without a requirement for site-specific geophysical survey data?
- Do you agree to the scoping out of the assessment of transboundary effects related to marine geology, oceanography and physical processes?
- Do you agree with the proposed approach to assessment of cumulative effects related to marine geology, oceanography and physical processes?

7 Marine Water & Sediment Quality

7.1 Introduction

This chapter of the Offshore Scoping Report identifies the Marine Water and Sediment Quality (MW&SQ) features of relevance to the Offshore Proposed Development and considers the potential impacts from the construction, O&M and decommissioning of the Offshore Proposed Development on MW&SQ, up to MHWS. MW&SQ is considered a receptor, whilst simultaneously providing an impact pathway to other receptors.

This chapter should be read in conjunction with:

- Chapter 6: Marine Geology, Oceanography and Physical Process; and
- Chapter 8: Benthic Subtidal and Intertidal Ecology.

This chapter of the Offshore Scoping Report had been prepared by GoBe Consultants.

7.2 Study Area

The Array Areas are located on a geological area known as the East Shetland platform (Figure 7.1).

The study area is defined by the MHWS tidal level, and the ZoI which is calculated to be 12 km. The ZoI is a perimeter that surrounds the Array Areas and the OfECC, defined using tidal ellipses.

The study area will be further refined during the EIA process using a more detailed consideration of tidal ellipse and sediment plume dispersion as per Chapter 6: Marine Geology, Oceanography and Physical Process.

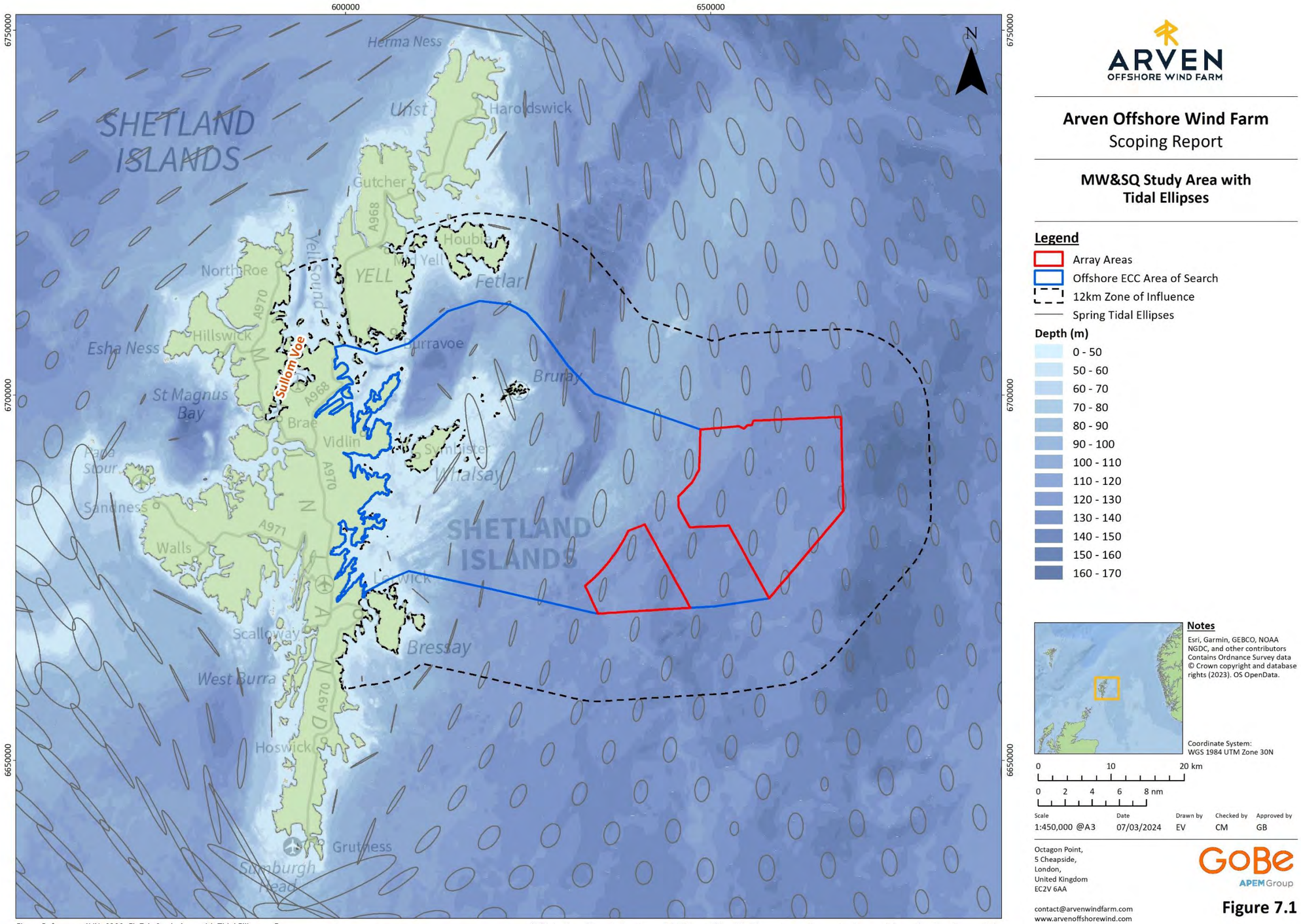

Figure Reference: AVN_0200_Fig7.1_Study Area with Tidal Ellipses_v5

ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

MW&SQ Study Area with Tidal Ellipses

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Zone of Influence
- Spring Tidal Ellipses

Depth (m)

- 0 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 110
- 110 - 120
- 120 - 130
- 130 - 140
- 140 - 150
- 150 - 160
- 160 - 170

Notes

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System: WGS 1984 UTM Zone 30N

0 10 20 km

0 2 4 6 8 nm

Scale	Date	Drawn by	Checked by	Approved by
1:450,000 @A3	07/03/2024	EV	CM	GB

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APEM Group

Figure 7.1

Figure 7.1: MW&SQ Study Area with Tidal Ellipses

7.3 Data Sources at Scoping

The data sources that have been used to inform this MW&SQ chapter are presented in Table 7.1. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data that is collected for the Offshore Proposed Development.

Table 7.1: Data sources used to inform Marine Water and Sediment Quality scoping chapter

Title	Summary	Source	Author and year
Benthic Subtidal and Intertidal Ecology Survey Campaign (Array Areas)	Sediment contamination analysis to be undertaken on sediment samples from within the survey area boundary, which was inclusive of the Array Areas and portion of adjacent Pobie Bank SAC.	Held by the Developer	Ocean Ecology 2023
BGS Offshore Geoindex	Data outputs on sediment types and coverage, with access to primary grab data. Other data on geology and deposit thicknesses, along with data from the BGS data base.	https://mapapps2.bgs.ac.uk/geoindex_offshore	BGS (2023)
Scottish Environment Protection Agency, Bathing Waters results for Scotland	Data outputs from the annual sampling programme SEPA runs for designated Bathing Waters in Scotland (running from 15 May to 30 September). The current status of each designated Bathing Water is available online. This dataset is included within the NMPi database. Bathing Water samples are taken from select locations annually, no samples within the study area	https://www2.sepa.org.uk/bathingwaters/Locations.aspx	SEPA (2022/2023)

Title	Summary	Source	Author and year
Water Classification Hub	An interactive map produced by SEPA which features the current status for various quality elements of Scottish waterbodies (e.g., surface-/groundwaters and protected areas). This dataset is included within the NMPi database. Water quality elements of relevance to the Offshore Proposed Development will be considered within the EIA. This dataset provides partial coverage of the OfECC Area of Search (inshore region). This data is collected annually, with data available dating back to 2007.	https://www.sepa.org.uk/data-visualisation/water-classification-hub/	SEPA (2020)
Shellfish Water Protected Areas	A map produced by the Scottish Government, presenting the designated Shellfish Water Protected Areas (SWPAs) in Scottish territorial waters. These waterbodies are designated under the Water Environment and Water Services (Scotland) Act 2003 and the Water Environment (Shellfish Water Protected Areas: Designation) (Scotland) Order 2013. This data is available on the NMPi, although the SEPA website provides the updated information. Relevant designated waterbodies will be considered within the EIA.	https://www.sepa.org.uk/environment/water/shellfish-water-protected-areas/	SEPA (2022)

Title	Summary	Source	Author and year
Urban Waste Water Treatment Regulations (UWWTR) Sensitive Areas	A map produced by SEPA presenting the Scottish waters sensitive to the effects of sewage dischargers, as designated under the Urban Waste Water Treatment (Scotland) Regulations 1994. This dataset is not available on the NMPi. Relevant waterbodies designated under the UWWTR will be considered within the EIA. This dataset provides partial coverage of the OfECC Area of Search (inshore region). This data includes the 2019 designated sensitive areas, but no other temporal data.	https://www.gov.scot/publications/urban-waste-water-treatment-sensitive-areas-map/	SEPA (2019)
Annual Mean Sea Surface Salinity (‰) – Climatology of the North-West European Continental Shelf 1971-2000	The data available on the Marine Scotland NMPi map, displaying the salinity of the surface waters in the Scottish Continental Shelf areas of the North Sea. This information is taken from the NMPi database. The sea surface salinity of waters relevant to the Offshore Proposed Development will be considered within the EIA. This dataset provides full coverage of the Offshore Proposed Development (Array Areas and OfECC Area of Search).	https://marine.gov.scot/maps/74	Marine Scotland (NMPi) (2017a),

Title	Summary	Source	Author and year
Annual Mean Surface Temperature (°C) – Climatology of the North-West European Continental Shelf for 1971-2000	The data available on the Marine Scotland NMPi map, displaying the temperature of the surface waters in the Scottish Continental Shelf areas of the North Sea. This information is taken from the NMPi database. The sea surface temperature of the waters relevant to the Offshore Proposed Development will be considered within the EIA. This dataset provides full coverage of the Offshore Proposed Development (Array Areas and OfECC Area of Search).	https://marine.gov.scot/maps/72	Marine Scotland (NMPi) (2017b)
Suspended Sediment Climatologies Around the UK	A dataset providing records from 1999-2019, utilised in the assessment for the UK's Clean Seas Environmental Monitoring Program (CSEMP). Long-term environmental monitoring is being undertaken in the UK, including measurements taken regarding sediment contamination. This data is not available on the NMPi. Data does not cover the Array Areas or the OfECC, however assumptions can be made due to its very close proximity, within 25 km.	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584621/CEFAS_2016_Suspended_Sediment_Climatologies_around_the_UK.pdf	Cefas (2016)

7.4 Description of the Baseline Environment

An understanding of the MW&SQ baseline has been derived from the publicly available data sources and literature, as presented in Table 7.1.

Designations of relevant waterbodies are also considered within this MW&SQ Chapter (such as Water Framework Directive (WFD) waterbodies, Bathing Waters, SWPAs), alongside the physical characteristics of the environment. This baseline understanding will be developed further through the completion of project-specific surveys, which will help inform the subsequent EIAR.

7.4.1 Array Areas

7.4.1.1 Sediment Type

In the study area between 100 m and 120 m depth, sands are the primary sediment (BGS, 2023; DECC, 2004). From 120 m to 160 m, mud content increases, notably in the West Unst Basin (DECC, 2004).

The Array Areas are comprised of mostly sand with components of sandy gravel and gravelly sand (BGS,2023). Mud fractions are typically low, well below 10% of the samples (BGS, 2023). See Section 7.4.2.1.1 for a characterisation of the OfECC. Project specific grab samples will be used to provide further detail on the sediment characteristics within the Array Areas.

7.4.1.2 Suspended Sediment Concentration

Whilst there is currently no publicly available data regarding SSC for the Array Areas, SPM concentrations, from which turbidity can be determined, are available up to, approximately, 25 km south of the Array Areas, (Cefas, 2016). Given the absence of land masses in proximity to the Array Areas, in addition to the water depths (greater than 110 m), it is considered that this data set can be used to inform on turbidity levels. This data shows the region just south of the Array Areas has SPM levels less than 1 mg/l (Cefas, 2016).

7.4.1.3 Sediment Quality

7.4.1.3.1 Sediment Contamination

There are no formal quantitative Environmental Quality Standards (EQS) for sediments, unlike for water quality, with the standards presented in the EQS Directive mainly relating to concentrations of contaminants dissolved in the water column. As the proposed works will not result in the release of contaminants into the water column directly, assessment focuses on the potential to disturb sediment bound contaminants.

In the absence of quantified standards, common practice for characterising baseline sediment quality conditions is to compare levels against the Action Levels for disposal of dredged material, as defined by Marine Scotland (2017). These Action Levels, as shown in Table 7.2, are used as part of a 'weight of evidence' approach to assessment of material suitable for sea disposal. Generally, contaminant levels falling below Action Level 1 (AL1) are not of concern and are unlikely to impact the final licensing decision. If contaminant levels fall above Action Level 2 (AL2), they are generally considered unsuitable for disposal at sea. Dredged material with sediment contaminant levels between AL1 and AL2 require professional judgement to be employed for a decision to be made. The Action Levels should not be viewed as a pass or fail system but

provide an appropriate context for professional consideration for contaminant levels in sediment for activities which propose to disturb the seabed.

Table 7.2: Action Levels Used in Sediment Contaminants Assessments (Source: Marine Scotland, 2017)

Contaminants	**Action Levels**	
	Action Level 1 (mg/kg)	Action Level 2 (mg/kg)
Arsenic	20	70
Cadmium	0.4	4
Chromium	50	370
Copper	30	300
Lead	50	400
Mercury	0.25	1.5
Nickel	30	150
Zinc	130	600
Tributyltin (TBT)	0.1	0.5
Polychlorinated Biphenyls (PCBs)	0.02	0.18
Polyaromatic Hydrocarbons (PAHs)	0.1	n/a
Total Hydrocarbons	100	n/a

A summary of the metallic contaminant concentrations reported at the five CSEMP monitoring stations within the region of East Shetland located of closest proximity to the Offshore Proposed Development, with data collected between 2008 to 2016, are presented in Table 7.3. The contaminant concentration was generally low with no exceedances of AL1 or AL2.

Table 7.3: Summary of Metallic Contaminant Concentrations in Sediment from 2020 CSEMP Monitoring Points of Relevance (Source: Marine Scotland, 2022a).

Metal	**Sediment Contaminant Concentration (mg/kg)**				
	Intermediate SE01 (2006 to 2016)	Open Sea SE01 (2019)	Open Sea SE02 (2014 to 2019)	Open Sea SE03 (2019)	Open Sea SE04 (2019)
Distance to closest Project boundary (km)	12 (south of OfECC)	81 (northeast of Array Areas)	45 (northeast of Array Areas)	50 (east of Array Areas)	41 (northeast of Array Areas)
Cadmium	$\bar{X}$ =0.07 n=30 (0.05-0.12)	$\bar{X}$ =0.08 n=3 (0.08-0.08)	$\bar{X}$ =0.08 n=1	$\bar{X}$ =0.08 n=3 (0.08-0.08)	$\bar{X}$ =0.08 n=3 (0.08-0.08)
Chromium	$\bar{X}$ =27.4 n=30 (15.9-53.6)	$\bar{X}$ =20.2 n=3 (18.6-23.1)	$\bar{X}$ =18.9 n=1	$\bar{X}$ = 17.83 n=3 (14.5-20.0)	$\bar{X}$ =20.73 n=3 (16.3-28)
Copper	$\bar{X}$ =4.09 n=30 (2.55-20.5)	$\bar{X}$ =3.53 n=3 (3.13-3.96)	$\bar{X}$ =3.32 n=1	$\bar{X}$ =2.966 n=3 (2.27-3.38)	$\bar{X}$ =3.49 n=3 (2.7-4.8)
Mercury	$\bar{X}$ =0.014 n=25 (0.0074-0.03)	$\bar{X}$ =0.179 n=3 (0.149-0.261)	$\bar{X}$ =0.162 n=1	$\bar{X}$ =0.011 n=3 (0.093-0.12)	$\bar{X}$ =0.144 n=3 (0.185-0.126
Nikel	$\bar{X}$ =11.11 n=30 (5.79-60.5)	$\bar{X}$ =7.86 n=3 (7.07-9.03)	$\bar{X}$ =7.57 n=1	$\bar{X}$ =6.93 n=3 (5.29-7.79)	$\bar{X}$ =7.96 n=3 (6.17-11.1)
Lead	$\bar{X}$ =11.27 n=30 (9.07-17)	$\bar{X}$ =9.87 n=3 (9.2-10.6)	n/a	$\bar{X}$ =10.08 n=3 (9.14-10.7)	$\bar{X}$ =10.1 n=3 (9.25-11.1)
Zinc	$\bar{X}$ =18.84 n=30 (13.9-42.3)	$\bar{X}$ =15.26 (14.1-17.1)	$\bar{X}$ =14 n=1	$\bar{X}$ =13.6 n=3 (11.3-14.9)	$\bar{X}$ =15.13 n=3 (11.5-20.4)

$\bar{X}$ = mean concentration (minimum-maximum), n = number of samples.

7.4.1.4 Water Quality

Annual mean surface temperature (°C) and salinity (‰) data within the Array Areas, specifically in the cells relevant to the Offshore Proposed Development (5342, 5341, 5340, 5341, 5492, 5491, 5490, 5641, 5642, 5639, 5638, 5639, 5789, 5788) have been collated from data available on Scotland's NMPi (NMPi, 2017a; NMPi, 2017b) (Table 7.4, Figure 7.2 and Figure 7.3). This data presents a three-decade summary from 1971 to 2000 of the salinity/surface temperature for regions of Northwest European shelf seas.

Table 7.4: Sea Surface Salinity and Temperature in the Array Areas and Offshore ECC

Month	**Mean Surface Water Temperatures (°C)**		**Mean Sea Surface Salinity ‰**	
	Array Areas	Offshore ECC	Array Areas	Offshore ECC
January	7.90	7.92	35.22	35.21
February	7.53	7.54	35.25	35.24
March	6.91	7.05	35.21	35.22
April	7.53	7.58	35.31	35.32
May	8.35	8.45	35.27	35.27
June	10.49	10.34	35.28	35.27
July	12.13	11.83	35.11	35.19
August	13.10	12.71	35.05	35.16
September	11.72	11.61	35.22	35.21
October	10.75	10.84	35.24	35.24
November	9.8	9.9	35.21	35.21
December	8.77	8.92	35.24	35.24

Within the Array Areas, the highest monthly average sea surface temperature occurred in August at 13.10°C, and the lowest monthly average was in March at 6.91°C. The sea surface salinity monthly average peaks at 35.31‰ in April, with the monthly average minimum salinity being in August at 35.05‰. Monthly sea surface temperature and salinity are shown in Table 7.4, Figure 7.2 and Figure 7.3.

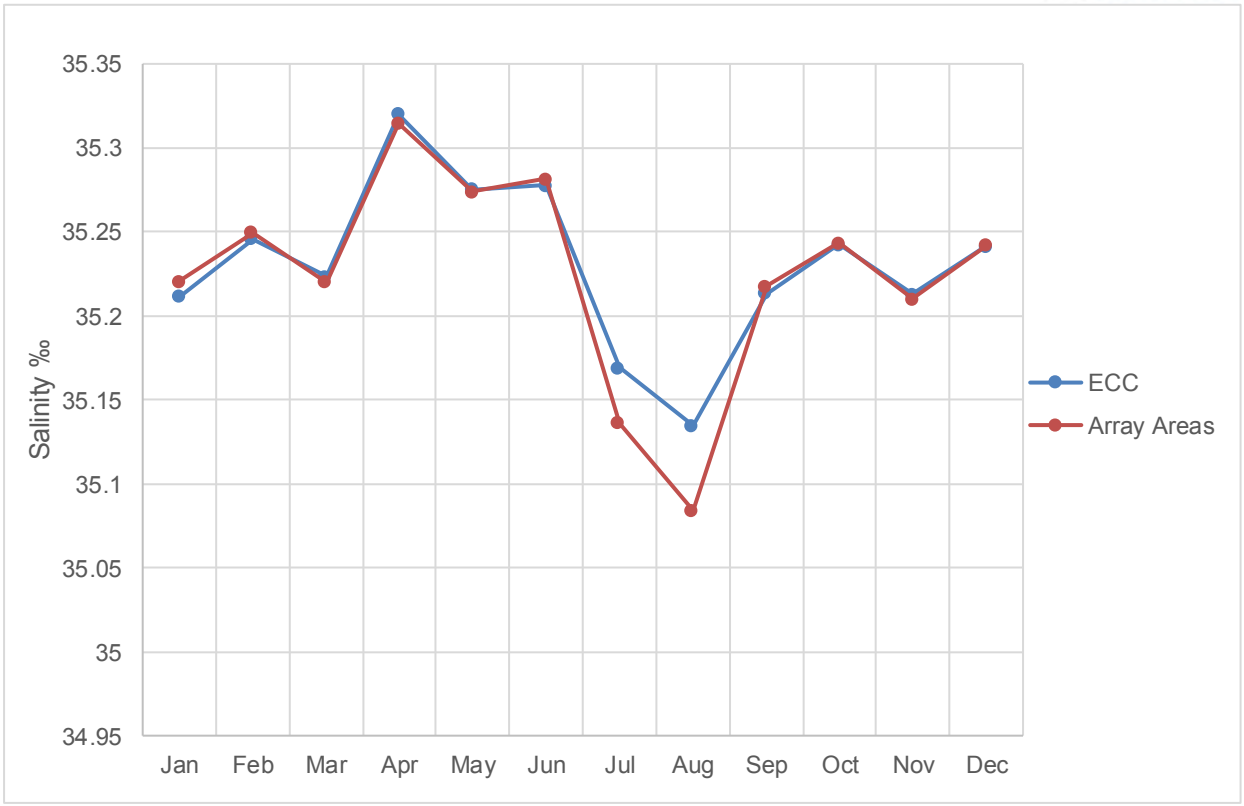

Figure 7.2: Sea Surface Salinity in the Array Areas and Offshore ECC (NMPi, 2017b)

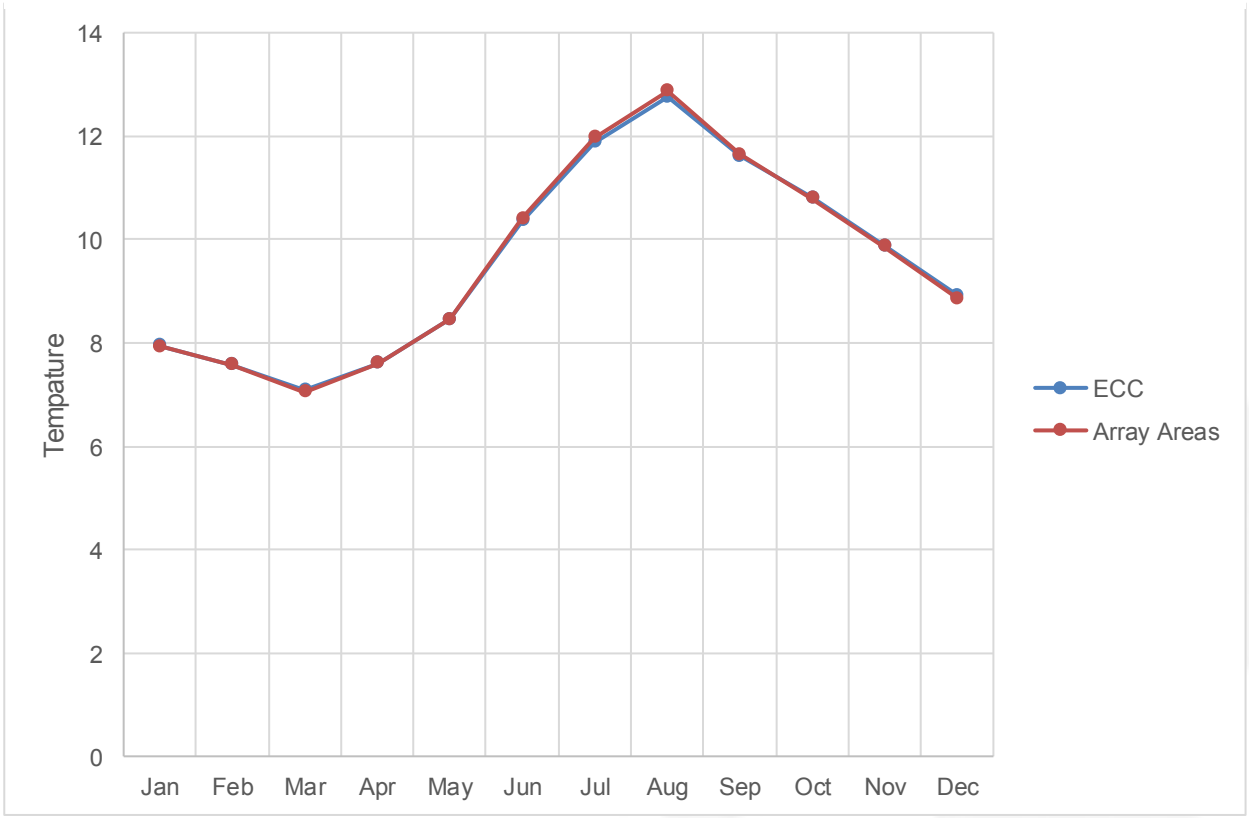

Figure 7.3: Sea Surface Temperature in the Array Areas and the Offshore ECC (NMPi, 2017a)

7.4.2 Offshore ECC

7.4.2.1 Sediment Quality

7.4.2.1.1 Sediment Type

Generally, for those sections of the OfECC between 100 m and 120 m, sands are the predominant surficial sediment type (BGS, 2023; DECC, 2004). In depths greater than 120 m, the proportion of mud within the sediment increases, for example in the West Unst Basin (DECC, 2004). Closer to the shore of Shetland, the influence of an energetic hydrodynamic regime (with further detail provided in Chapter 6: Marine Geology, Oceanography and Physical Process for more information) results in the absence of finer sediments such that coarser sediments, such as gravels, dominate the sediment regime (DECC, 2004).

7.4.2.1.2 Sediment Contamination

Sediment contamination information relevant to the OfECC is presented in Section 7.4.1.3.1; it is indicated that no samples exceed AL1 or AL2. Project specific sediment sampling will be undertaken within the OfECC to inform on sediment contamination levels.

Sediment samples were taken within Yell Sound and Sullom Voe, see in Figure 7.1, by the Shetland Oil Terminal Environment Advisory Group (SOTEAG) (SGS, 2018). The mean results for PAHs throughout the sample in 2018 was 1.23 mg/kg which is above AL1 in Table 7.2, there is an absence of AL2 for PAH (see Table 7.2). However, these results are outside the Offshore Proposed Development, located a minimum of 6 km away and are from a vicinity with O&G activity (SGS, 2018).

7.4.2.1.3 Suspended Sediment Concentration

As presented in Section 7.4.1.2, there is no publicly available SSC information available within the OfECC. However, 25 km south of the OfECC, there is little variation shown in SSC with values of the order of 1 mg/l throughout an annual period (Cefas, 2016). Higher values are anticipated closer to the shore, particularly during the winter months when increased storm activity disturbs seabed sediments, leading to increased SSC levels.

7.4.2.2 Water Quality

Annual mean surface temperature (°C) and salinity (‰) data in the OfECC, have been collated from data available on the NMPi (NMPi, 2017a; NMPi, 2017b) (seen in Table 7.4). This data presents a summary of the salinity/surface temperature for regions of Northwest European shelf seas from 1971 to 2000 (NMPi, 2017a; NMPi 2017b). Within the OfECC, the highest monthly sea surface temperature occurred in August at 12.71°C, and the lowest monthly average was in March at 7.05°C. The sea surface salinity monthly average peaks at 35.32‰ in April, with the monthly average minimum salinity being in August at 35.16‰. Monthly sea surface temperature and salinity are shown in Table 7.4 and Figure 7.2 and Figure 7.3.

7.4.3 Landfall

7.4.3.1 Water Framework Directive

The WFD (2000/60/EC) established a framework for the protection and management of Europe's water resources. The WFD[3] identifies various interconnected waterbodies (seaward from low water to one nm) into discrete surface waterbodies. Ecological and chemical objectives are set for each surface waterbody, with the over-arching goal to achieve 'Good' status. To achieve a 'Good' overall status the waterbody must attain 'Good Ecological Status' (GES) and 'Good Chemical Status' (GCS).

Chemical status is assessed as either 'Good' (e.g., pass) or 'Fail', whereas ecological status can be 'High', 'Good', 'Moderate', 'Poor', 'Bad'.

Each discrete surface waterbody is assigned a hydromorphological designation, which describes how modified the waterbody is from its natural state. Waterbodies are assessed as either:

- Undesignated (e.g., un-affected by anthropogenic factors);
- Heavily Modified Waterbody (HMWB) (e.g., a surface waterbody which as a result of physical alterations by human activity is substantially changed in character); and
- Artificial Waterbody (AWB) (e.g., a surface waterbody created by human activity).

The default objective for HMWBs and AWBs is to achieve Good Ecological Potential (GEP), which is a status aimed at protecting the ecology of the waterbodies whilst also considering the role of their human use.

To assess the ecological status of surface waterbodies, multiple quality elements are utilised. These quality elements include biological (e.g., fish, phytoplankton, angiosperms, etc.), physico-chemical (e.g., dissolved oxygen and salinity), hydromorphological (e.g., hydrological regime), and several specific pollutants. Compliance with the chemical status objectives is assessed in the context of EQS, which sets out a list of 'priority' and 'priority hazardous' substances.

The overarching objective is to achieve GES/GEP and GCS in all inland and coastal waters. In an attempt to prevent a decline in the status of waterbodies, there is a general 'no deterioration' provision.

Another requirement is the development of River Basin Management Plans (RBMPs), which define distinct River Basin Districts. These distinct districts can be assessed, and measures set out for improving quality of surface and groundwater bodies (where necessary). RBMPs are reviewed, and an updated version published on a six-yearly cycle.

The first cycle of RBMPs was published in 2009, covering the period between 2009 to 2015, for the two districts in Scotland (the Solway Tweed and Scotland River Basin Districts, although a small portion of the Northumbria River Basin District is in Scottish waters). The second cycle plans were published in 2015, which updated the

[3] References to the WFD and other Directives in this Scoping Report should be read as references to the Directive as implemented by domestic legislation.

status and objectives of the original plans. The most recent updates were published in 2021, which cover the third cycle (from 2021-2027).

Detail pertaining to the waterbodies located within the MW&SQ study area is provided in Table 7.5 and the locations shown in Figure 7.4. Of note is that there are 19 coastal and no transitional waterbodies within the MW&SQ study area.

Table 7.5: Summary of the latest (2022) classification status for coastal waterbodies

Coastal Waterbody	Parameter																	
	Waterbody ID	Waterbody size (km^2)	Overall status	Pre HMWB status	Overall ecology	Physio- Chem	Dissolved Oxygen	Dissolved inorganic nitrogen	Biological elements	Benthic invertebrates (IQI)	Invertebrate animals	Macroalgae	Phytoplankton	Specific pollutants	Unionised ammonia	Hydromorphology	Morphology	Water quality
Herma Ness to Heoga Ness	200294	398.37	G	G	G	G	G	G	H	H	H	H	H	-	-	H	H	G
Yell Sound	200503	171.32	G	G	G	H	H	H	G	G	G	H	H	P	P	H	H	G
Heoga Ness to The Keen	200282	446.40	G	G	G	G	-	G	H	H	H	H	H	-	-	H	H	G
The Keen to Isle of Noss	200263	145.8	G	-	G	G	-	G	H	H	H	H	H	P	P	H	H	G
Bressay Sound	200246	9.55	G	G	G	G	-	G	G	H	G	H	H	-	-	G	G	G
Bluemull Sound and West Fetlar	200289	80.70	G	G	G	G	-	G	H	H	H	H	H	-	-	H	H	G
Sullom Voe	200281	19.30	G	G	G	H	H	H	G	G	G	-	H	H	P	H	H	G
Isle of Noss to Sumburgh Head	200256	348.30	G	G	G	G	-	G	H	H	H	H	H	-	-	H	H	G
Dales Voe (South Mainland)	200250	3.40	G	G	G	H	H	H	G	G	G	-	H	P	P	H	H	G
Dales Voe (North Mainland)		200276	3.50	G	G	G	H		H	H	G	G	G	-	H	P	P	H	H	G
Lax Firth	200252	2.40	G	G	G	H	H	H	G	G	G	-	H	P	P	H	H	G
Wadbister Voe	200255	1.50	G	G	G	H	H	H	G	G	G	H	H	P	P	H	H	G
Cat Firth	200260	3.50	G	G	G	H	H	H	G	G	G	-	H	P	P	H	H	G
Dury Voe	200267	14.0	G	G	G	H	H	H	G	G	G	H	H	P	P	H	H	G
Vidlin Voe	200273	2.90	G	G	G	H	H	H	G	G	G	-	H	P	P	H	H	G
Swining Voe	200274	3.90	G	G	G	H	H	H	G	G	G	-	H	P	P	H	H	G
Colla Firth	200275	1.50	G	G	G	H	H	H	G	G	G	-	H	P	P	H	H	G
The Houb	200277	0.20	G	G	G	H	H	H	G	G	G	-	-	P	P	H	H	G
Ness of Galtagarth	200283	0.10	G	G	G	-	-	G	H	H	H	-	-	-	-	H	H	G
Mussel Loch	200447	0.10	G	G	G	G	-	G	H	H	H	-	-	-	-	H	H	G

P – Pass; M – Moderate; G – Good; H – High; - no information available

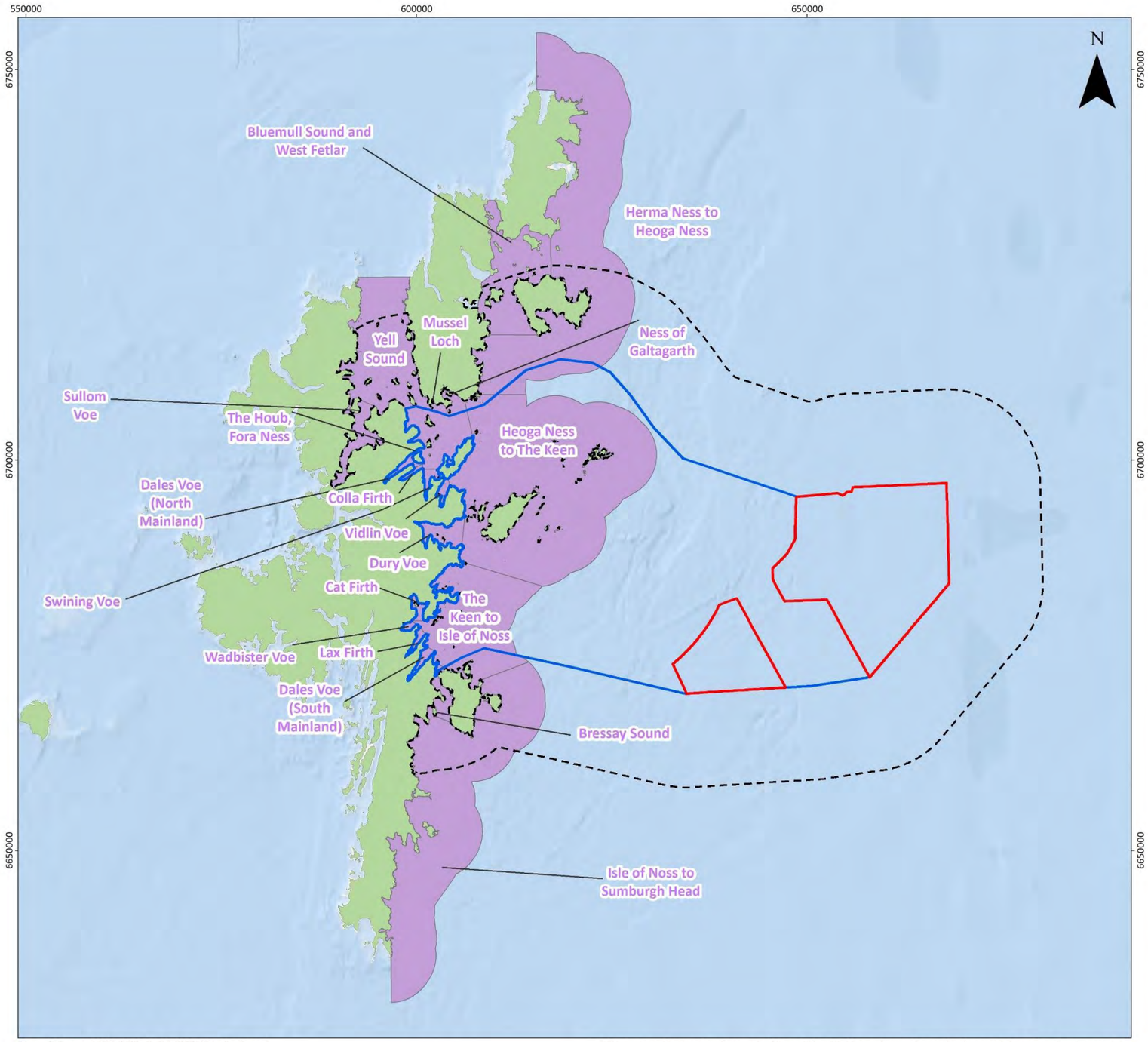

Figure Reference: AVN_0200_Fig7.4_WFD Waterbodies_v4

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WFD Waterbodies

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Zone of Influence
- Coastal Waterbodies

Notes

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Coordinate System: WGS 1984 UTM Zone 30N

0 10 20 km
0 5 10 nm

Scale	Date	Drawn by	Checked by	Approved by
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Figure 7.4

Figure 7.4: WFD Waterbodies

7.4.3.2 *Bathing Waters*

In March 2006, the EU's revised Bathing Water Directive (rBWD; 2006/7/EC) was brought into force. The revised Directive provided more stringent standards than the previous Bathing Water Directive (BWD; 76/160/EEC), with more emphasis on making information publicly available. This rBWD is implemented in Scotland through The Bathing Waters (Scotland) Regulations 2008.

The rBWD relied on fewer microbial indicators than the BWD, whilst setting higher standards. Bathing waters are classified according to the levels of certain bacteria (e.g., intestinal enterococci and Escherichia coli) in samples collected during the bathing season (which runs from May until September). These bathing waters are monitored annually, and results reported against the rBWD indicators. The newer classification system considers all samples collected for the previous three bathing seasons for each bathing water, with classification of performance reported as:

- Excellent- the highest, cleanest class.
- Sufficient- water quality meets minimum required standards; and
- Poor- water quality does not meet the minimum required standards.

There are no designated bathing waters located along the coastline in the OfECC Area of Search.

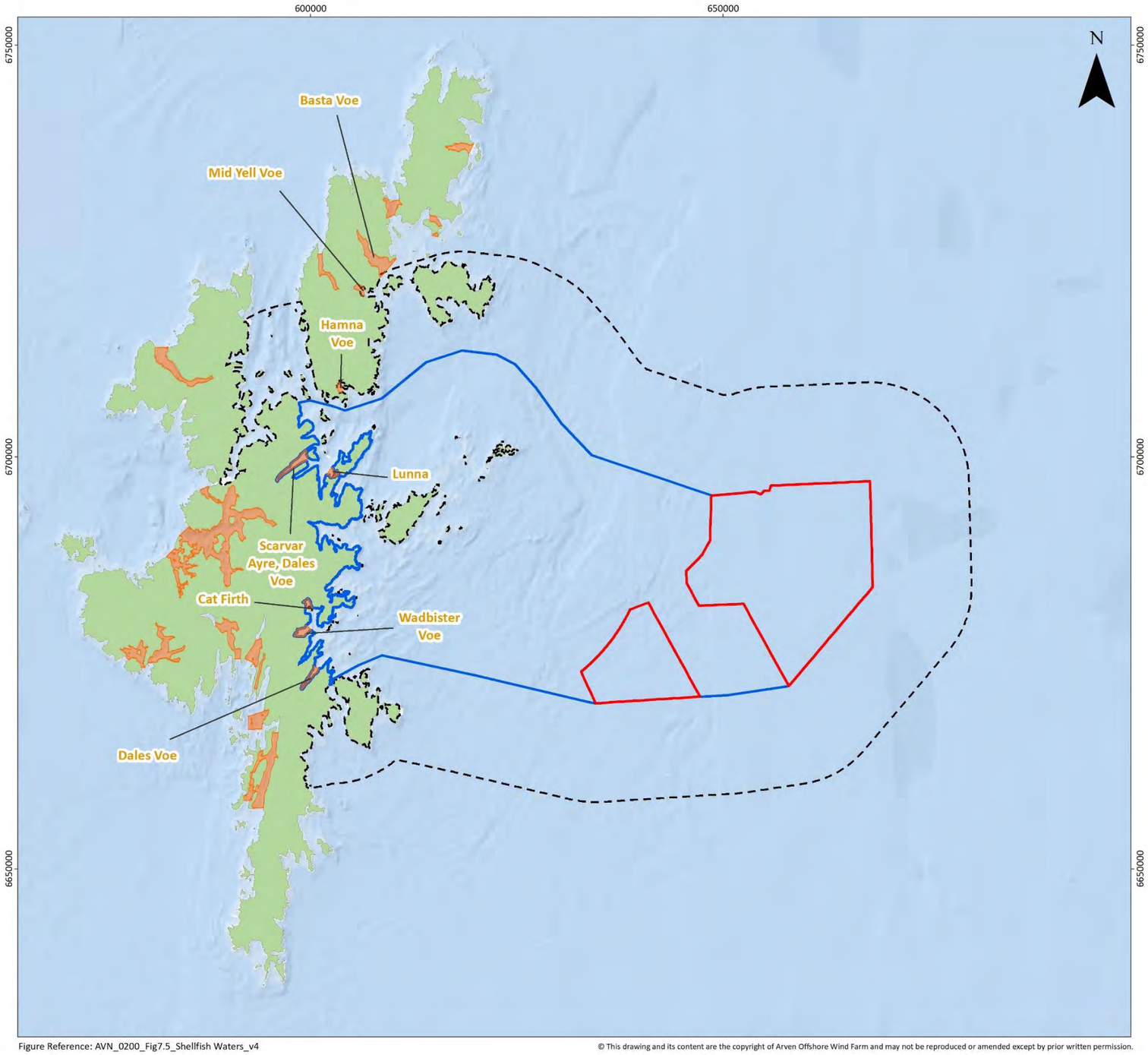
7.4.3.3 *Shellfish Waters Protected Areas*

In 2013, the Shellfish Waters Directive (2006/113/EC) was repealed and subsumed within the WFD. This is implemented in Scotland through the Water Environment (Shellfish Water Protected Areas: Designation) (Scotland) Order 2013. This Order identified 85 coastal areas within Scottish territorial limits as shellfish waters, which are presented in a series of maps (Scottish Government, 2019).

The Water Environment (Shellfish Water Protected Areas: Environmental Objectives etc.) (Scotland) Regulations 2013 set environmental objectives for the Shellfish Water Protected Areas (SWPAs), whereas the Scotland River Basin District (Quality of Shellfish Water Protected Areas) (Scotland) Directions 2021 and the Water Environment (Shellfish Water Protected Areas: Objectives and Classification etc.) (Solway Tweed) Directions 2021 direct SEPA on how to assess and classify the SWPAs in each Scottish River Basin District.

The Directions enable SEPA to classify SWPAs (e.g., 'Excellent', 'Good', or 'Insufficient') based on set thresholds for the 'most probable number of Escherichia coli per 100 g sample of shellfish flesh and intra-valvular liquid as a 90-percentile standard'.

Shetland has a high density of SWPAs in comparison to the rest of Scotland with 22 SWPAs across all its islands, as well as several SWPAs within the OfECC, such as Dales Voe, Wadbister Voe, Cat Firth, Lunna, and Scarvar Ayre, as well as Hamna Voe and Mid Yell Voe just north of the OfECC Area of Search. Of note is that Basta Voe is located immediately adjacent to the ZoI and as such is included as a precautionary measure. These locations support shellfish species and significantly contribute to the economy of the region and are protected in status. As shown in Figure 7.5, there are five designated sites located directly within the OfECC and a further two located within the MW&SQ ZoI.



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Scoping Report

Shellfish Waters Within the Proposed Development

Legend
- Array Areas
- Offshore ECC Area of Search
- 12km Zone of Influence
- Shellfish Waters Protected Areas

Notes
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Coordinate System:
WGS 1984 UTM Zone 30N

0 10 20 km
0 2 4 6 8 nm

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Figure 7.5

Figure Reference: AVN_0200_Fig7.5_Shellfish Waters_v4

Figure 7.5: Shellfish Waters Within the Offshore Proposed Development

7.4.3.4 Sensitive Areas

The Urban Waste Water Treatment Directive (91/271/EEC) is implemented in Scotland through the Urban Waste Water Treatment (Scotland) Regulations 1994 (UWWTRs). The UWWTRs aim to protect the environment from adverse impacts from the collection, treatment, and discharge process associated with urban wastewater. The UWWTRs set treatment levels for wastewater, based on the sizes of the sewage discharges and the sensitivity of the receiving waters.

The UWWTRs generally require that collected wastewater is treated to (at least) secondary treatment standard for significant discharges. Secondary treatment is a biological process wherein bacteria break down biodegradable matter (which will already be greatly reduced from original levels by the primary treatment process). Under the UWWTRs, sensitive areas are defined as waterbodies affected by eutrophication or elevated nitrate concentrations, that act as indicators for if action is needed to prevent further pollution by nutrients.

East Shetland has 37 WWT outfalls into the sea, with six industrial outfalls. Of the 37 WWT outfalls 36 are primary[4] and one is secondary (SMA, 2011). Shetland's Coastal and Transitional Classification is 'Good' (Marine Scotland, 2011).

There are no Sensitive Areas within the MW&SQ study area.

7.4.3.5 Blue Carbon Assessment

In 2014, SNH (now NatureScot) commissioned a report assessing the blue carbon stores around the Scottish coast. This report led to the output of various blue carbon maps, showing the predicted and observed habitat extent for various blue carbon stores (e.g. seagrass, saltmarsh meadows). These maps indicate there is predicted to be kelp habitat in the vicinity of the Offshore Proposed Development's Landfall, which will need consideration in the full assessment. There are no predicted kelp habitats within the Array Areas, and no predicted saltmarsh within the Array Areas or OfECC (Burrows *et al*., 2014).

There are no predicted seagrass habitats in the Array Areas, however there are seagrass beds 12 km north of Lerwick which may be affected by the OfECC (NMPi, 2017c).

Kelp is present around most of the coast of Shetland with up to 20% cover, with the various levels of cover generally decreasing with depth (NMPi, 2017c).

Coastal and offshore sediments are known to be the main repositories of carbon in the marine environment, with an estimated 18,000,000 t of organic carbon stored in the top 10 cm of sediments in Scotland's marine regions (Burrows *et al*., 2014). Phytoplankton and kelp are the main sources of carbon entering carbon storage,

[4] Primary treatment removes material that will either float or readily settle out by gravity, it includes the physical processes or screening, comminution, grit removal and sedimentation.

with coastal species (such as saltmarsh and seagrass) contributing, although less significantly due to the limited habitat extent.

A blue carbon assessment will be undertaken in the EIAR. This will build further upon assessments conducted within Chapter 8: Benthic Subtidal and Intertidal Ecology chapter, with a focus on potential impacts of the Offshore Proposed Development on marine sediments.

7.5 Embedded Mitigation

Mitigation measures will be considered and implemented throughout the Offshore Proposed Development's various design stages and are intended to reduce any associated potential environmental impacts. The proposed mitigation measures will evolve throughout the EIA and development process, adapting in response to consultation responses, where appropriate.

The Embedded Mitigation measures adopted by the Offshore Proposed Development (relevant to MW&SQ) are presented below:

- C-1: Development of and adherence to a CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
- C-2: Development of and adherence to a DSLP. The DSLP will confirm the layout and design parameters of the Offshore Proposed Development.
- C-4: Development of and adherence to a CMS. The CMS will confirm construction methods and the roles and responsibilities of parties engaged in construction. It will detail any construction-related mitigation measures.
- C-6: Development of and adherence to an EMP. The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management.
- C-12: Development of and adherence to a Project Environmental Monitoring Programme (PEMP), which will set out commitments to environmental monitoring in pre-, during and post-construction project phases.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Offshore Proposed Development.
- C-17: Development of and adherence to an OMP. The OMP will describe operation and maintenance activities and provide an indicative schedule for the undertaking of these.
- C-20: Scour Protection will be deployed where there is the potential for scour to develop around infrastructure (Foundations and cables).
- C-29: Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP.
- C-32: Suitable implementation and monitoring of cable protection (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible), as detailed within the CaP.

7.5.1 Summary of Key Receptors

The primary receptors for MW&SQ within the study area are identified as follows:

- SWPAs within the study area i.e., Dales Voe, Wadbister Voe, Cat Firth, Lunna, and Scarvar Ayre, as well as Hamna Voe;

- Blue Carbon stores within the study area, seagrass 12 km off of Lerwick and kelp present throughout the Shetland Isles; and,
- Coastal and transitional waterbodies within the ZoI.

7.6 Scoping of Impacts

An initial assessment of the likelihood of effects on MW&SQ due to the Offshore Proposed Development activities for the scoping stage of the EIA process, is presented in Table 7.6 and Table 7.7. Table 7.6 presents the impacts scoped into the MW&SQ assessment and Table 7.7 displays the impacts scoped out of the MW&SQ assessment. MW&SQ also provides an impact pathway for other marine receptors, and as such information relating to MW&SQ pathways will be used to inform other EIA topic assessments, namely:

- Chapter 8: Benthic Subtidal and Intertidal Ecology;
- Chapter 9: Fish and Shellfish Ecology;
- Chapter 10: Marine Mammals; and
- Chapter 13: Commercial Fisheries.

Table 7.6: Impacts scoped into the assessment of MW&SQ

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Construction and Decommissioning			
Deterioration in water quality due to suspension of sediments.	Temporary elevations in SSCs arising from construction/ decommissioning activities (such as foundation installation or cable laying) may result in adverse effects on marine water quality. This reduction in water quality may be indicated by changes in levels of nutrients and dissolved oxygen, a reduction in water clarity, and changes in primary production levels.	A characterisation of the baseline will be provided, including details of the presence and extent of sediment types which will be described using existing and new site-specific survey data. The sensitivity of the environment to the impact will be determined through available literature, designations and expert judgement. The magnitude of the impact will be informed by the physical processes assessment, including the assessment of the predicted sediment plume concentrations and longevity.	C-1 (CaP), C-2 (DSLP), C-14 (DP), C-29 (Cable Burial)
Deterioration in water clarity	To undertake trenchless cable installation techniques (such as HDD) which may be required at landfall, drilling mud, such as bentonite (or another inert mud) may be required. This may result in the release of drilling mud at the punch out point. In MW&SQ terms, the primary issue relating to bentonite release comes from potential increase in SSC in the water column, and potential reduction in bacterial mortality. Any activities which result in seabed disturbance during the decommissioning phase may also result in a deterioration in water clarity.	The assessment will present the maximum volume (and rate) in which inert drilling mud may be released into the environment. The determination of the sensitivity of receptors and magnitude will utilise the same approach as outlined for the impact 'Deterioration in water quality due to suspension of sediments'.	C-1 (CaP), C-2 (DSLP), C-12 (PEMP), C-14 (DP), C-32 (Cable Protection)
Release of sediment-bound contaminants from disturbed sediments.	Temporary elevations in SSC from construction/ decommissioning activities may lead to release of sediment-bound contaminants into the water column. This temporary re-suspension and redistribution of existing contaminant may have adverse effects on water quality.	The presence and extent of sediment bound contaminants will be described using existing and new site-specific survey data. The sensitivity of the environment to the impact will be determined through available literature, designations and expert judgement. The magnitude of the impact will be informed by the physical	C-1 (CaP), C-2 (DSLP), C-12 (PEMP), C-14 (DP), C-29 (Cable Burial), C-32 (Cable Protection)

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
		processes assessment, including the assessment of the predicted sediment plume concentrations and longevity.	
Deterioration in status of WFD coastal waterbodies	A temporary increase in SSC as a result of construction and decommissioning activities may result in adverse effects on marine water quality and the deterioration in status of nearby coastal and transitional waterbodies. A WFD compliance assessment will be produced as part of the EIA to assess potential impacts to WFD waterbodies and protected areas.	Given the boundaries of WFD waterbodies only extend to one nm from the low water mark, it is anticipated that potential impacts would be associated with landfall works only. The determination of the sensitivity of receptors and magnitude will utilise the same approach as outlined for the impact 'Deterioration in water quality due to suspension of sediments'.	C-1 (CaP), C-6 (EMP), C-12 (PEMP), C-14 (DP)
Operation and Maintenance			
Deterioration in water quality due to the suspension of sediments from O&M activities.	Should a section or sections of any cables become exposed or damaged, there would be a requirement for reburial or replacement. This may result in adverse effects on marine water quality through temporary increases in SSC (including release of sediment bound contaminants, reduction in clarity and increases in nutrient concentrations).	Cable reburial (or replacement) would be undertaken using similar techniques to those which were used to originally install the cables. The same approach will be adopted as impact 'Deterioration in water quality due to suspension of sediments' and 'Release of sediment-bound contaminants from disturbed sediments'.	C-1 (CaP), C-2 (DSLP), C-12 (PEMP), C-17 (OMP), C-20 (Scour Protection), C-32 (Cable Protection)
Deterioration in status of WFD coastal waterbodies from O&M activities.	A temporary increase in SSC as a result of O&M activities may result in adverse effects on marine water quality and the deterioration in status of nearby coastal and transitional waterbodies. A WFD compliance assessment will be produced as part of the EIA to assess potential impacts to WFD waterbodies and protected areas.	Given the boundaries of WFD waterbodies only extend to one nm from the low water mark, it is anticipated that potential impacts would be associated with works at landfall. The same approach will be adopted as impact 'Deterioration in status of WFD coastal waterbodies'.	C-1 (CaP), C-6 (EMP), C-12 (PEMP), C-17 (OMP)

Table 7.7: Impacts scoped out of the assessment of MW&SQ

Impact	Justification
Construction and Decommissioning Phases	
Accidental release or spills of materials or chemicals.	There is potential for accidental spills or release of materials/ chemicals from vessels associated with the construction and decommissioning activities. However, impacts are anticipated as being short-lived and highly localised. In the event of an accidental spillage, hydrocarbons would be rapidly dispersed or diluted. Moreover, vessels associated with the Offshore Proposed Development will be required to comply with strict environmental controls set out in the EMP and Marine Pollution Contingency Plan (MPCP), which will minimise risk and set out provisions for responses to spills during construction and decommissioning activities. Due to the implementation of control measures and small quantities of chemical and hydrocarbons, it is proposed to scope this impact out of further consideration within the EIA.
Deterioration in Bathing Water quality.	The activities associated with the construction and decommissioning of the Offshore Proposed Development have the potential to result in deterioration to Bathing Water classifications. For example, increased turbidity resulting from sediment plumes may reduce bacterial mortality, impacting the Bathing Water classifications for that bathing season. However, there are no designated Bathing Waters within the study area, allowing this to be scoped out of the assessment.
Operational and Maintenance Phase	
Deterioration in water quality due to re-suspension and deposit of sediments from scour.	There is potential for elevated SSC resulting from scour around infrastructure, including foundations and cable protection. Considering that the volume of suspended sediment released during operation via scour would be far lower than that released during construction or repair activities, it is proposed for this impact to be scoped out from further consideration within the EIA. Moreover, the effects will be highly localised and associated volumes of mobile sediments are considered within the range of natural variability.
Changes in water and sediment quality associated with the cleaning of infrastructure.	Some routine maintenance activities on infrastructure (such as removal/cleaning of biofouling) have potential to result in reduced water and sediment quality in the immediate vicinity of the activity.

Impact	Justification
	These operational cleaning activities may release some substances, such as anti-fouling paint into the marine environment. Any potential impacts from these activities are expected to be highly localised, small scale, temporary and short-lived. Risks will be managed through the embedded commitment measures presented.
Accidental release or spills of materials or chemicals.	There is potential for accidental spills or release of materials/chemicals during maintenance works from associated vessels during the O&M phase. However, impacts are anticipated as being short-lived and highly localised. In the event of an accidental spillage, hydrocarbons would be rapidly dispersed or diluted. Moreover, vessels associated with the Offshore Proposed Development will be required to comply with strict environmental controls set out in the EMP and MPCP, which will minimise risk and set out provisions for responses to spills during O&M activities. Due to the implementation of control measures and small quantities of chemical and hydrocarbons, it is proposed to scope this impact out of further consideration within the EIA.

7.7 Potential Cumulative Impacts

The process by which potential cumulative impacts will be assessed through the CIA is described in Chapter 4: EIA Methodology. For MW&SQ these cumulative interactions may occur with other planned OWF, or other industries with operations or developments in the study area.

The MW&SQ study area is consistent with that presented in Chapter 6: Marine Geology, Oceanography and Physical Process, and may be refined further following assessment and analysis of tidal excursions and sediment transport pathways. The effects of the Offshore Proposed Development are anticipated to be localised to the footprint of the works, although there is potential for certain impacts to interact with other developments, resulting in a larger cumulative effect. There is potential for cumulative effects in the construction, O&M, and decommissioning phases of the Offshore Proposed Development.

The CIA for MW&SQ will consider the maximum adverse design scenario for the Offshore Proposed Development with other relevant developments and will be aligned with the methodology presented in Chapter 6: Marine Geology, Oceanography and Physical Process.

7.8 Potential Transboundary Impacts

There are no transboundary impacts on MW&SQ pathways expected resulting from the construction, O&M, or decommissioning activities associated with the Offshore Proposed Development due to the distance to the UK Territorial Water boundary; 130 km. Therefore, it is proposed for transboundary impacts regarding MW&SQ to be scoped out of the subsequent EIA.

7.9 Proposed Approach to EIA

7.9.1 Relevant Guidance

In addition to the approach and guidance (of general relevance) outlined in Chapter 4: EIA Methodology, the assessment of MW&SQ receptors will also comply with the following guidance:

- Pre-disposal Sampling Guidance. Version 2 - November 2017 (Marine Scotland, 2017c);
- Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications (Marine Scotland, 2018) and any subsequent web based updates;
- Guidance for Pollution Prevention (GPP) Note 5 (GPP5) - Works and maintenance in or near water produced by NRW, and Northern Ireland Environment Agency (NIEA) and SEPA (2018);
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Cefas, 2012);
- EIA for offshore renewable energy projects (BSI, 2015);
- Review of Cabling Techniques and Environmental Effects Applicable to the Offshore Wind Farm Industry (BERR, 2008a); and
- OSPAR Assessment of the Environmental Impacts of Cables (OSPAR, 2009).

In the absence of formal Scottish guidance on the preparation of WFD compliance assessments, the standard approach is to follow the Environment Agency's 'Clearing the Waters for All' process (Environment Agency, 2016), as well as Advice Note Eighteen: The Water Framework Directive (Planning Inspectorate, 2017). If alternative guidance is suggested in consultation, this approach will be adopted going forward, where

appropriate. This guidance outlines how to assess the impact(s) of activities upon WFD designated waterbodies and is set out in the following key stages:

- Screening: for the exclusion of activities which do not need to be taken forward to the scoping or impact assessment stages;
- Scoping: for the identification of receptors and quality elements which are potentially at risk from the proposed activities, and will require further assessment; and
- Impact Assessment: for the consideration of the potential impacts from an activity, identification of ways to avoid/minimise impacts, and indication if an activity may cause deterioration in waterbody status/jeopardise potential of waterbody to achieve 'Good' status.

7.9.2 Anticipated Additional Data Sources at EIA

A thorough, desk-based collation and review of the relevant data will be undertaken to inform the subsequent EIA, building upon the high-level outline provided within this Offshore Scoping Report. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions. These are expected to include a benthic ecology survey of a refined OfECC.

7.9.3 Assessment Methodology

The EIA will follow the EIA approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report.

The study area for the MW&SQ baseline within the EIA will be as outlined here but will be refined further following project refinement, detailed desk-based literature review and work undertaken for Chapter 6: Marine Geology, Oceanography and Physical Process. The scope of this MW&SQ assessment is to characterise the physical and chemical conditions within the study area and assess how these may be impacted from the Offshore Proposed Development. This information will be used to assess the potential impacts to MW&SQ receptors in isolation, as well as helping to inform other technical topic assessments, such as Chapter 8: Benthic Subtidal and Intertidal Ecology, Chapter 9: Fish and Shellfish Ecology, Chapter 10: Marine Mammals, and Chapter 13: Commercial Fisheries.

The MW&SQ assessment will take into account the magnitude and duration of the impact, the reversibility of the impact, and the timing and frequency of the activity. An assessment of the potential impacts will be informed by the assessment undertaken in Chapter 6: Marine Geology, Oceanography and Physical Process, in addition to the evidence base. The significance of environmental changes will be compared against the anticipated natural variability within (or long-term changes to) the marine environment due to natural cycles (such as storm events).

Consultation will be undertaken as needed throughout the EIA process (e.g., with the Marine Directorate, NatureScot, and SEPA), ensuring the approach taken and proposed evidence base satisfy the requirements of stakeholders and regulators (see Chapter 5: Consultation).

7.10 Scoping Questions

The following scoping questions refer to the MW&SQ chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those data listed in Table 7.1 and any additional anticipated data listed in Sections 7.3 and 7.9.2 being used to inform the Offshore EIA?
- Do you agree with the MW&SQ study area proposed in Figure 7.1?
- Do you agree that all receptors related to MW&SQ have been identified?
- Do you agree with the scoping in and out of impacts related to MW&SQ?
- Do you agree on the suitability of the embedded mitigation measures proposed for MW&SQ?
- Do you agree with the proposed assessment methodology proposed for MW&SQ?
- Do you consider that a WFD compliance assessment is required for the Offshore Proposed Development?
- Do you agree to the scoping out of the assessment of transboundary effects related to MW&SQ?
- Do you agree with the proposed approach to the assessment of cumulative effects related to MW&SQ?

8 Benthic Subtidal and Intertidal Ecology

8.1 Introduction

This chapter of the Offshore Scoping Report identifies the benthic subtidal and intertidal ecology pathways and receptors of relevance to the Offshore Proposed Development, and considers the potential impacts from the construction, O&M and decommissioning of the Offshore Proposed Development upon benthic subtidal and intertidal ecology, up to MHWS.

This chapter should be read alongside:

- Chapter 6: Marine Geology, Oceanography and Physical Process;
- Chapter 7: Marine Water & Sediment Quality; and
- Chapter 9: Fish and Shellfish Ecology.

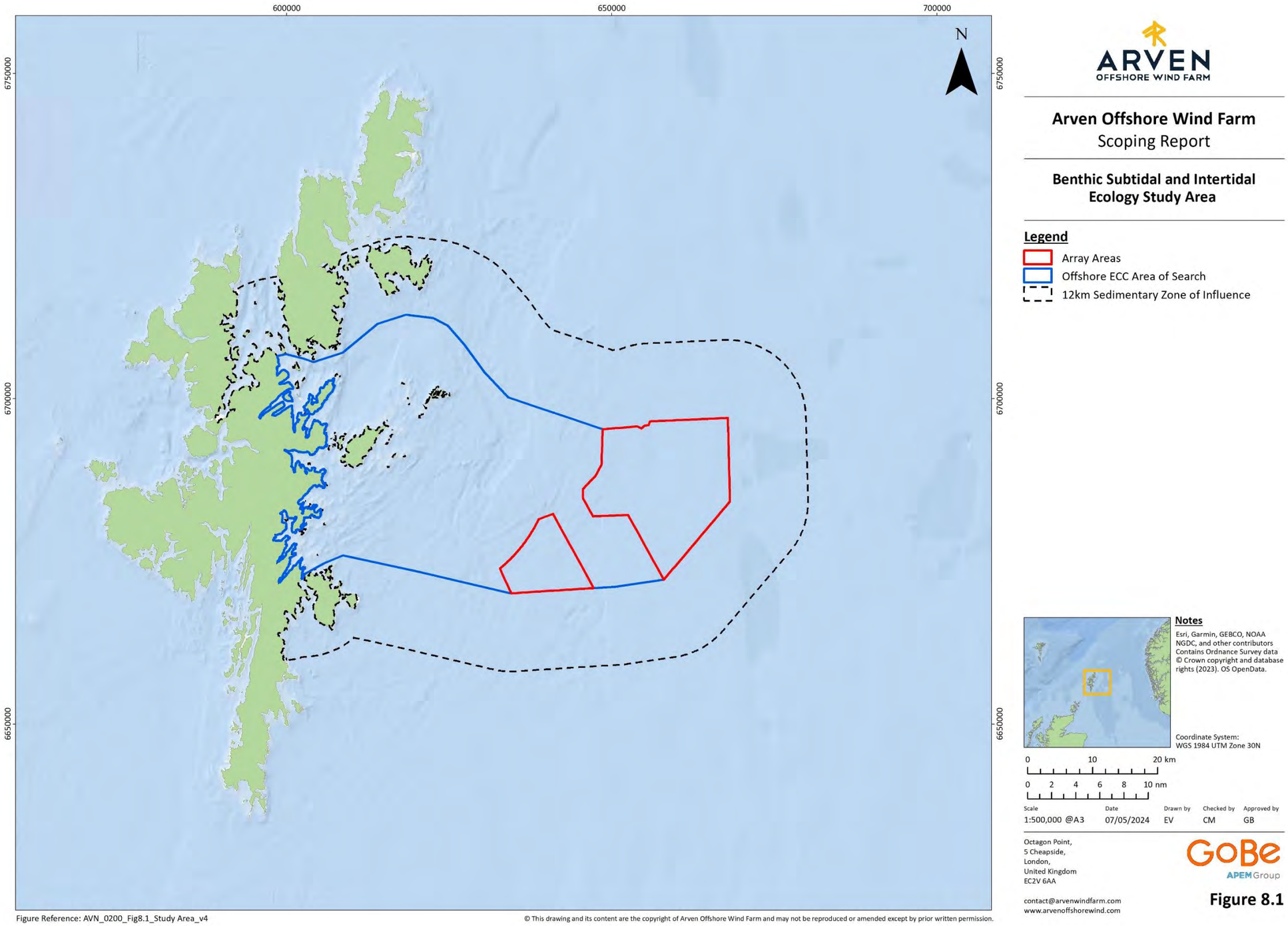
This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants.

8.2 Study Area

The benthic subtidal and intertidal ecology study area is presented spatially in Figure 8.1 and is defined by the Offshore Proposed Development's footprint (includes the Array Areas, the OfECC and the Landfall Area of Search), plus a buffer which represents a wider ZoI associated with potential sedimentary impacts.

The sedimentary ZoI encompasses the area over which suspended sediment might travel following disturbance as a result of the Offshore Proposed Development's activities. This sedimentary ZoI includes a buffer around the Offshore Proposed Development defined by the mean spring tidal excursion which represents the expected maximum distance that suspended sediments may be transported on a mean spring tide in a flood and /or ebb direction (although most suspended sediments are expected to be deposited much closer to the disturbance activity). The tidal excursion distances surrounding the Array Areas and the OfECC range from 4 to 8 km from the Offshore Proposed Development. Therefore, as a precautionary measure, the sedimentary ZoI has been defined as a 12 km buffer from the Offshore Proposed Development. This 12km buffer does not however extend past the east coast of Shetland to the west coast due to the presence of the Shetland land mass. The intertidal ecology study area is defined by the Landfall Area of Search contained within the ZoI, which extends from the MLWS mark up to the MHWS mark.

This study area is likely to be refined, as required, at post-scoping stages to reflect any site-specific sediment plume modelling work that will be undertaken as part of the Marine and Coastal Processes assessment (see Chapter 6), as well as stakeholder consultation and refinements to the project design including definition of a refined OfECC within the current area of search. This will result in a condensed study area for the EIAR which will be based on all activities carried out throughout the proposed development stages.



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Scoping Report

Benthic Subtidal and Intertidal Ecology Study Area

Legend
- Array Areas
- Offshore ECC Area of Search
- 12km Sedimentary Zone of Influence

Notes
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Coordinate System:
WGS 1984 UTM Zone 30N

0 10 20 km
0 2 4 6 8 10 nm

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Figure 8.1

Figure Reference: AVN_0200_Fig8.1_Study Area_v4

Figure 8.1: Benthic Subtidal and Intertidal Ecology Study Area

8.3 Data Sources at Scoping

The data sources that have been used to inform this benthic subtidal and intertidal ecology chapter are presented in Table 8.1. These data sources will be taken forward and used to inform the EIA baseline characterisation, alongside any additional site-specific data that will be collected for the study area.

Table 8.1: Data sources used to inform benthic subtidal and intertidal ecology scoping chapter

Title	Summary	Source	Author and year
Publicly Available Datasets			
EMODnet Broad-Scale Seabed Habitat Map for Europe (EUSeaMap) (2021) European Nature Information System (EUNIS) 2022 habitat types	Broadscale seabed habitat map for Europe	https://emodnet.ec.europa.eu/geoviewer/	EMODnet, 2021
OneBenthic faunal data points and habitat mapping	National broadscale data	https://rconnect.cefas.co.uk/onebenthic_portal/	Cefas, 2019
Protected Annex I Reefs in offshore SACs - polygon data - WMS layer | JNCC Resource Hub	Composite Annex I reef data for the UK	https://hub.jncc.gov.uk/assets/dfc01272-7ea5-41ea-ac04-c89eb848a768	JNCC, 2023
Pobie Bank Reef SAC 2020 Cruise Report (1220S)	A benthic survey report outlining the findings of geophysical, DDV and sediment grabs to characterise and monitor the conditions of the SAC	https://hub.jncc.gov.uk/assets/f207f461-207e-417b-8d54-d91d9c04d52c	Albrecht & Stirling 2021
Pobie Bank 2013 Biodiversity and 2009 Site Interpretation Data	Biodiversity analysis from surveying at Pobie Bank in 2013 and site data used as an input to SAC habitat maps	Provided by JNCC	JNCC, 2009 & 2013

Title	Summary	Source	Author and year
Offshore and Inshore SPA Pobie Bank Reef Conservation Objectives and Advice on Operations	Information on the Conservation Objectives for the SAC	https://data.jncc.gov.uk/data/748a0001-ac8a-4ae0-95df-ece63e02a57f/PBR-ConservationObjectives-AdviceonOperations-v3.0.pdf	JNCC, 2013
Pobie Bank Reef SAC Site Selection Assessment	Detailed information about the Pobie Bank Reef site and evaluation of interest features according to the Habitats Directive selection criteria and guiding principles (including feature mapping)	https://data.jncc.gov.uk/data/748a0001-ac8a-4ae0-95df-ece63e02a57f/PBR-SAC-SAD-v5.0.pdf	JNCC 2012
Marine Protected Area (MPA) Network	A definition and overview of the Scottish MPA network	https://marine.gov.scot/node/12790	Marine Scotland, 2024 (now Marine Directorate (MD))
Kelp bed data	Scottish kelp bed habitat data layers	https://marine.gov.scot/node/14689	Marine Scotland, 2024 (now MD)
Burrowed mud data	Scottish burrowed mud habitat data layers	https://marine.gov.scot/node/14626	Marine Scotland, 2024 (now MD)
Ocean Quahog data	Records of ocean quahog in Scottish waters data layers	https://marine.gov.scot/node/12704	Marine Scotland, 2024 (now MD)
Shetland Islands Marine Region State of the Environment Assessment	The assessment aims to provide a baseline assessment of the Shetland marine and coastal environment out to 12 nm, using	https://www.shetland.uhi.ac.uk/t4-media/one-web/shetland/research/docum	University of the Highlands and Islands, 2017

Title	Summary	Source	Author and year
	the most up-to date data available as of December 2016.	ent/marine-spatial-planning/state-of-environment-assessment/shetland-state-of-the-marine-environment-assessment-april-17.pdf	
Sullom Voe Dataset			
Chemical and Macrobenthic Monitoring in Sullom Voe Sediments 2018 Report	Biannual macrobenthic survey report of the Sullom Voe area, to monitor environmental characteristic and changes over time	https://soteag.org.uk/wp-content/uploads/2019/07/2018-SOTEAG-Macrobenthic-Monitoring.pdf	SGS UK Limited and Eco Marine Consultants Limited, 2018
Distribution modelling of the Shetland Islands benthic habitats	The analysis highlights the predicted habitat suitability and distribution of various biotopes across Shetland.	https://pureadmin.uhi.ac.uk/ws/portalfiles/portal/52614439/Riley_et_al_2024_-_Distribution_modelling_of_the_Shetland_Islands_benthic_habitats.pdf	Riley T., *et al.* (2024)
Site Specific Data			
Benthic Subtidal and Intertidal Ecology Survey Campaign (Array Areas)	Site specific data collected across the Array Areas and adjacent seabed within a portion of the	Held by Developer	Ocean Ecology, 2023

Title	Summary	Source	Author and year
	SAC. Included DDV, sediment grabs and contaminant analysis		

8.4 Pre-Scoping Engagement

A pre-scoping consultation workshop was held with MD-LOT, MD-SEDD, SIC, UHI Shetland and NatureScot in November 2023 to present a summary of the existing baseline conditions and data sources used to establish this, alongside providing a summary of the potential impacts proposed for scoping in and scoping out of the benthic ecology EIA reporting. During the workshop MD-LOT and NatureScot provided the following advice and feedback:

- UHI Shetland hold additional data on closer to shore habitats, e.g. for maerl beds and horse mussel beds, collected to inform inshore fisheries management, these are publicly available;
- Updated predicted seabed habitat maps are due to be published by UHI Shetland, once published these can be shared;
- UHI Shetland has a wide non-native species maps/database which can be shared. A total of 12 locations are monitored on a twice-yearly basis.
- It was noted that sediment eDNA samples have been gathered and that guidance on how these should / could be analysed was awaited.

No other comments were provided with regards to the proposed scoping content. This additional information and data sources will be obtained as far as possible, once publicly available, in order to inform the EIAR.

8.5 Baseline Environment

The characterisation of the species and habitats found within the benthic subtidal and intertidal ecology study area has drawn upon publicly available datasets and monitoring reports from nearby development surveys. These key sources include benthic and geophysical surveys undertaken as part of the Sullom Voe oil terminal biannual macrobenthic monitoring.

8.5.1 Offshore Array Areas

A total of two broadscale sediment habitats have been identified within the Array Areas through a review of the EUSeaMap (2021) data. Figure 8.2 demonstrates that the Array Areas are dominated by deep circalittoral sand with patches of faunal communities on deep moderate energy circalittoral rock located towards the west and south of the Array Areas. Site-specific benthic surveys were undertaken in September / October 2023 across the Array Areas (drop down video, grab sampling and sediment sampling), with survey data currently undergoing analysis. Preliminary sediment classification was made in situ during the surveying based on a visual assessment of the grab samples, with sediment types observed as muddy sand, muddy gravel, and sand (Ocean Ecology, 2023).

Habitat survey point data (Figure 8.2; EMODnet, 2021) corresponds to the EUSeaMap (2021) data, as there are indications of faunal communities on deep moderate energy circalittoral rock within the north of the Arven South Array Area (Figure 8.2).

8.5.2 Offshore Export Cable Corridor

The OfECC is mainly characterised by faunal communities on deep moderate energy circalittoral rock (Figure 8.2; EUSeaMap, 2021). The EUSeaMap (2021) data indicates that there are three broadscale habitats present within the OfECC. Faunal communities on deep moderate energy circalittoral rock almost entirely dominates, with patches of deep circalittoral sand to the south and southeast, towards the Array Areas. There is a small area of deep circalittoral course sediments to the north of the OfECC, further towards the inshore waters.

Figure 8.2 also presents the One Benthic Faunal Data Points from Cefas (2019). The further offshore regions within the OfECC and wider study area were characterised by the following macrofaunal assemblages:

- D2a – represented a faunal assemblage that was characterised by the polychaetes *Spionidae*, *Glyceridae*, *Terebellidae*, *Capitellidae*, *Phyllodocidae* and the nematode family *Nemertea*. This group is likely to be located on a variety of sandy substrates;
- D2c – represented a faunal assemblage that was characterised by polychaetes including *Nephtyidae*, *Spionidae* and *Opheliidae*. All of which are typically found in sands and muddy sands; and
- D2b – was characterised by *Spionidae*, *Amphiuridae*, *Nephtyidae*, *Lumbrineridae*, *Oweniidae*, *Cirratulidae*, *Capitellidae*, *Nemertea*, *Semelidae*, *Ampharetidae*. D2b is widely found across the northern North Sea and Celtic Shelf, is typically associated with deep water, low bottom temperature, muddy habitats with low bottom current flows, high salinity and low chlorophyll.

PMFs of kelp beds, northern sea fan, sponge communities and kelp and seaweed communities on sublittoral sediment have been identified as likely to be present within the OfECC (Figure 8.4).

The OfECC area of search is inclusive of the Pobie Bank Reef SAC which is designated for its reef features (see Section 8.5.4).

Site-specific monitoring surveys conducted for the Sullom Voe oil terminal included chemical, particle size and hydrocarbon content analysis (SGS United Kingdom Ltd, 2018). The Sullom Voe survey collected samples from 32 stations throughout the Sullom Voe area, approximately 1.4 km from its nearest point to the Offshore Proposed Development (OfECC). The sediment samples were collected using a 0.1m^2 Day grab, the samples and sub samples were taken for the analysis of: sediment grain size, organic matter and total aliphatic hydrocarbons and aromatic hydrocarbons (SGS United Kingdom Ltd, 2018).

The survey found that the sediment characteristics were consistent with findings from the previous survey conducted in 2016, with the majority of sediments being categorised as gravelly muddy sand (Gravel 6.3%, Sand 38.5%, Mud 55.2%) to muddy sandy gravel (Gravel 54.7%, Sand 29.8%, Mud 15.5%; SGS United Kingdom Ltd, 2018).

The 'Shetland Islands Marine Region State of the Environment Assessment' (UHI, 2017) provides a baseline assessment of the Shetland marine and coastal environment out to 12 nm, using data available up to December 2016. It categorises specific receptors into five assessment criteria ranging from 'many concerns'

to 'no evidence'. Relevant benthic receptors and their overall assessment rating include: subtidal sediments identified as 'some concerns', subtidal rock identified as 'no concerns', intertidal sediment as 'some concerns' and intertidal rock as 'few concerns', The document provides a regional look forward which states that the number of non-native species present in Shetland continues to increase, but a biosecurity plan has been implemented to minimise potential impacts of introductions and that most seabed species are currently afforded some protection, where their location is known.

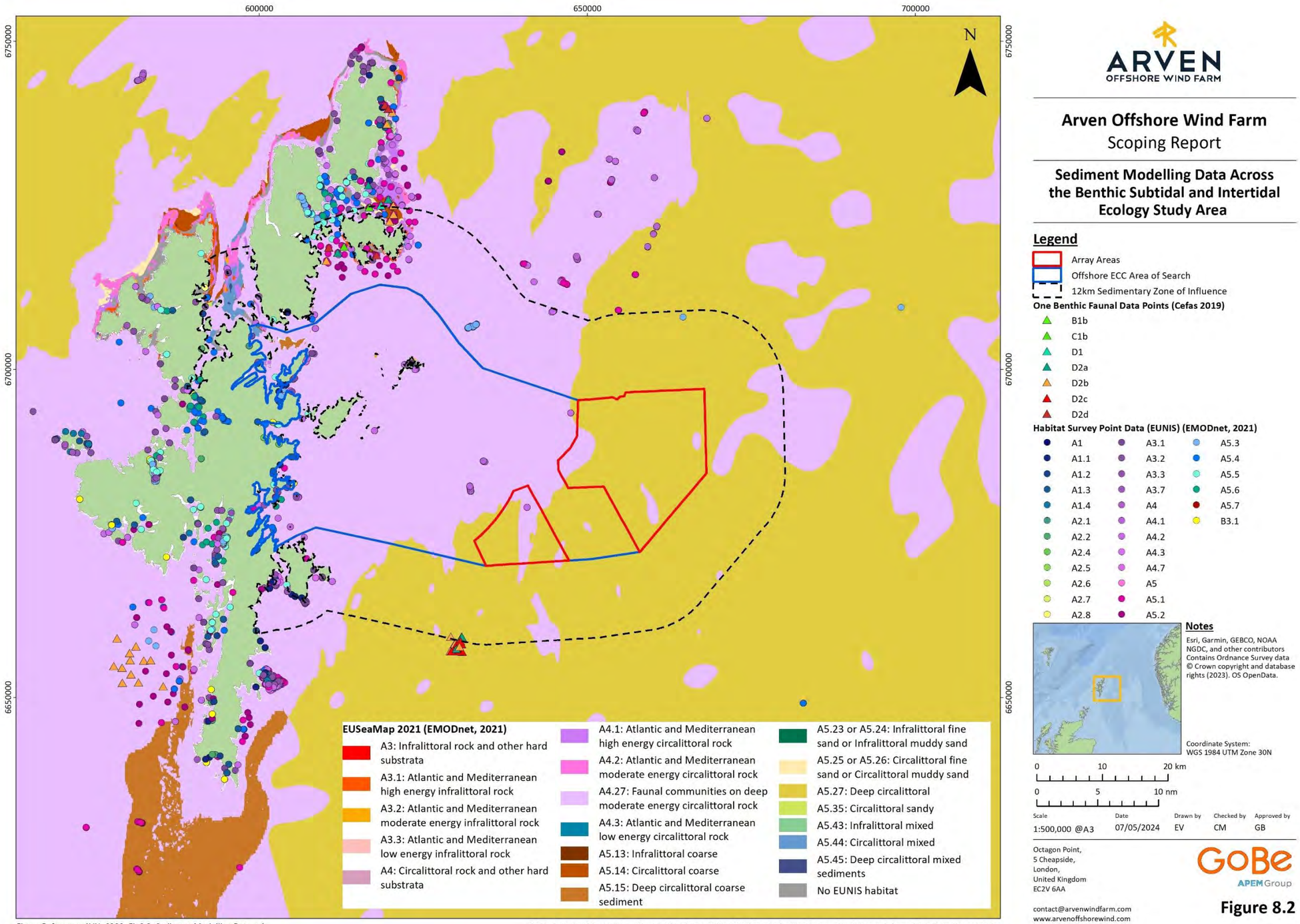
8.5.3 Intertidal and Landfall

At the point of writing, a preferred landfall site has not yet been confirmed, but a number of potential landfall sites have been identified within the OfECC Area of Search (Figure 8.3). The intertidal zone along this stretch of the east coast of Shetland is characterised by predominantly rock platforms with boulders/ loose rock, with a mixture of sandy and gravelly sediments, where there are bays with a backdrop of cliffs (Figure 8.3). MagicMap also highlights that there are rock platforms, rock platforms with banks of gravel and sand inlets and bays across this stretch of coastline (MagicMap, 2023; Figure 8.3).

PMFs kelp beds, horse mussel beds, seagrass beds, maerl beds, kelp and seaweed communities on sublittoral sediments and burrowed mud have been identified as likely to be present within the intertidal areas (Figure 8.4).

The intertidal zones of the Benthic ZoI are shown in Figure 8.2, and were characterised by the following macrofaunal assemblages:

- B1b - was characterised by the polychaetes *Spionidae, Serpulidae, Syllidae, Glyceridae, Galatheidae, Phyllodocidae, Terebellidae, Polynoidae, Capitellidae, Scalibregmatidae, Eunicidae, Cirratulidae* and the nematode family *Nemertea*.
- D1 - was characterised by *Spionidae, Montacutidae, Semelidae, Nephtyidae, Capitellidae, Cirratulidae, Amphiuridae, Oweniidae*, nematode family *Nemertea, Pholoidae* and *Nuculidae*.
- D2a – represented a faunal assemblage that was characterised by the polychaetes *Spionidae, Glyceridae, Terebellidae, Capitellidae, Phyllodocidae* and the nematode family *Nemertea*. This group is likely to be located on a variety of sandy substrates;
- D2b – was characterised by *Spionidae, Amphiuridae, Nephtyidae, Lumbrineridae, Oweniidae, Cirratulidae, Capitellidae, Nemertea, Semelidae, Ampharetidae*. D2b is widely found across the northern North Sea and Celtic Shelf, is typically associated with deep water, low bottom temperature, muddy habitats with low bottom current flows, high salinity, and low chlorophyll;
- D2d – was characterised by Spionidae*, Bathyporeiidae, Nephtyidae, Magelonidae* and *Tellinidae.*



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Sediment Modelling Data Across the Benthic Subtidal and Intertidal Ecology Study Area

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Sedimentary Zone of Influence

One Benthic Faunal Data Points (Cefas 2019)

- B1b
- C1b
- D1
- D2a
- D2b
- D2c
- D2d

Habitat Survey Point Data (EUNIS) (EMODnet, 2021)

A1	A3.1	A5.3
A1.1	A3.2	A5.4
A1.2	A3.3	A5.5
A1.3	A3.7	A5.6
A1.4	A4	A5.7
A2.1	A4.1	B3.1
A2.2	A4.2	
A2.4	A4.3	
A2.5	A4.7	
A2.6	A5	
A2.7	A5.1	
A2.8	A5.2	

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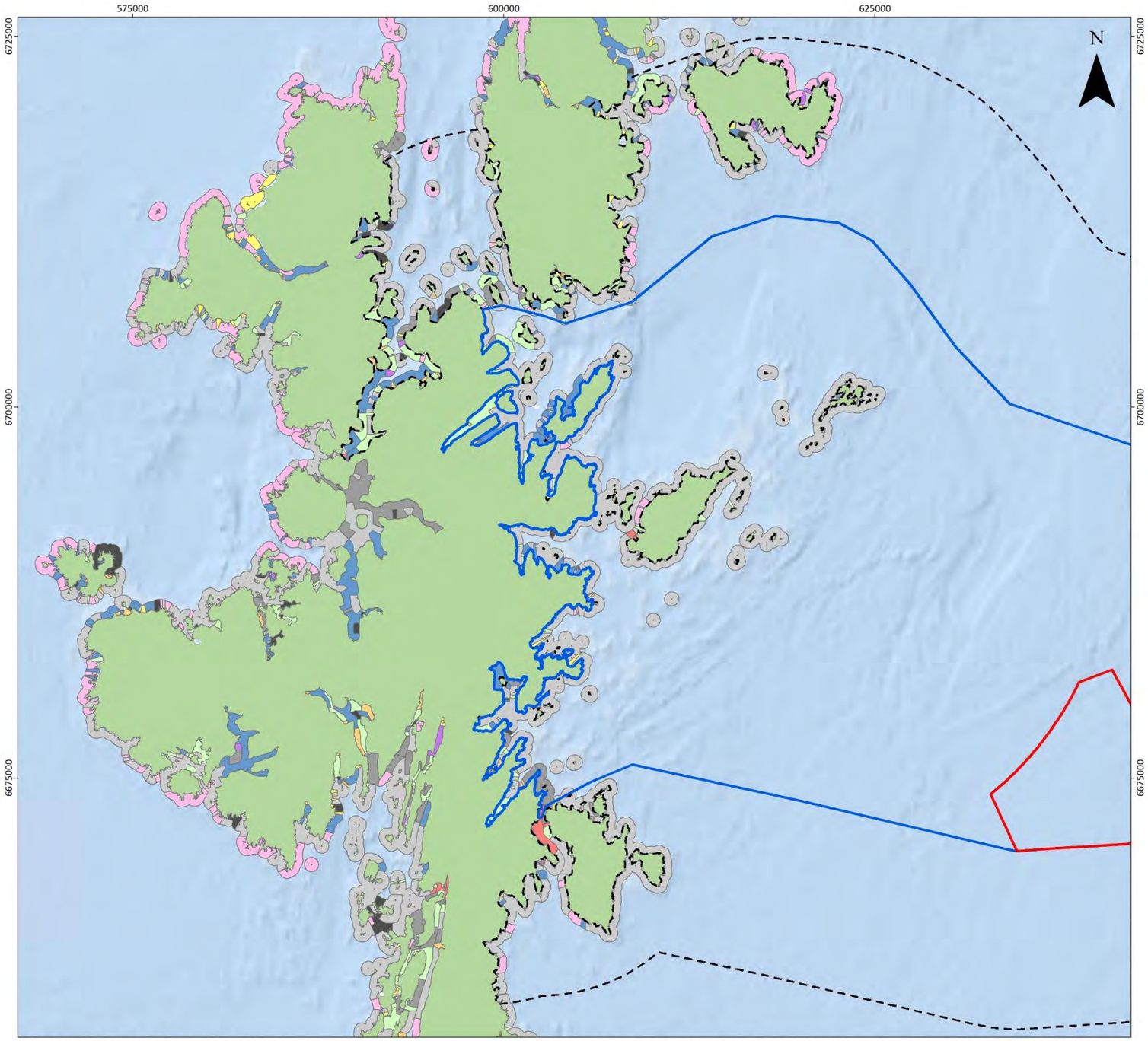
Figure 8.2

Figure Reference: AVN_0200_Fig8.2_Sediment Modelling Data_v4

Figure 8.2: Sediment Modelling Data Across the Benthic Subtidal and Intertidal Ecology Study Area



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Intertidal Seabed Substrates

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Sedimentary Zone of Influence

Intertidal Substrate Foreshore (BGS)

- Sand
- Sand and Gravel
- Sand and Mud
- Mud
- Mud and Gravel
- Gravel
- Rock Platform
- Rock Platform with Banks of Gravel
- Rock Platform with Boulders / Loose Rock
- Boulders / Loose Rock
- Made Ground (Man Made)
- Unspecified
- Not Present

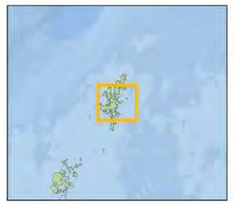

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Figure 8.3

Figure Reference: AVN_0200_Fig8.3_Intertidal Seabed Substrates_v4

Figure 8.3: Intertidal Seabed Substrates

8.5.4 Designated Sites and Features of Conservation Interest

As part of the benthic subtidal and intertidal ecology scoping exercise, a review has been undertaken to identify sites designated for nature conservation as well as protected species found within the study area.

Several designated sites have been identified within the study area. Sites designated for nature conservation within or in close proximity to the Offshore Proposed Development have been illustrated in Figure 8.4 and Figure 8.5. Only sites that have qualifying features related to benthic subtidal or intertidal ecology and that overlap with the study area have been listed within Table 8.2.

The OfECC currently intersects with the southern edge of the Pobie Bank Reef SAC (Figure 8.4). The Pobie Reef Bank SAC is approximately 70 km long, 21 km wide, 966 km^2 in area (JNCC, 2012) and has been designated for the protection of the Annex I Habitat geogenic reefs feature. The bank overlays a flat plain of sedimentary rock known as the East of Shetland Platform. The reef provides habitat to an extensive community of encrusting and robust sponges and bryozoans. In the shallowest areas the bedrock and boulders also support encrusting coralline algae (Marine Scotland, 2016). The deepest areas of the reef (>100 m) are known to support small erect sponges, cup corals (*Caryophyllia smithii*) and brittlestar (*Ophiura albida)* (Marine Scotland, 2016). Sea urchins *(Strongylocetrotus droebachiensis)*, encrusting coralline algae and dead man's fingers *(Alcyonium digitatum)* have also been identified as being present within the reef (Marine Scotland, 2016). Several studies have been undertaken within the SAC to allow detailed mapping of the reef features including the habitat mapping used within the site condition assessment (JNCC, 2012) which shows detailed mapping of bedrock, stony and mixed (bedrock and stony) reef within the southern extents of the SAC. Figure 8.5 presents the Annex I reef composite dataset available on the JNCC MPA Web Map Service (JNCC, 2023). Further data collection has been undertaken during the summers of 2013 (seabed mapping), 2020 (DDV, side scan sonar and multibeam echosounder) and 2023 (DDV and camera stills) and this data acquisition is understood to cover the whole of the seabed within the SAC, though it is noted that data analysis and reporting in some places is still ongoing/yet to commence. The Conservation Objectives for the SAC note that the reef is at high risk from disturbance and damage from demersal fishing activity and that the quality, processes, extent and physical structure should be maintained or restored (JNCC, 2013).

A refined OfECC within the current area of search will be defined ahead of EIA; this will seek to avoid interaction with the Pobie Bank SAC where practicable, though the Project may seek to explore potential routing through the SAC noting that a case will need to be made to support this and potential impacts on the SAC fully considered in EIA and HRA.

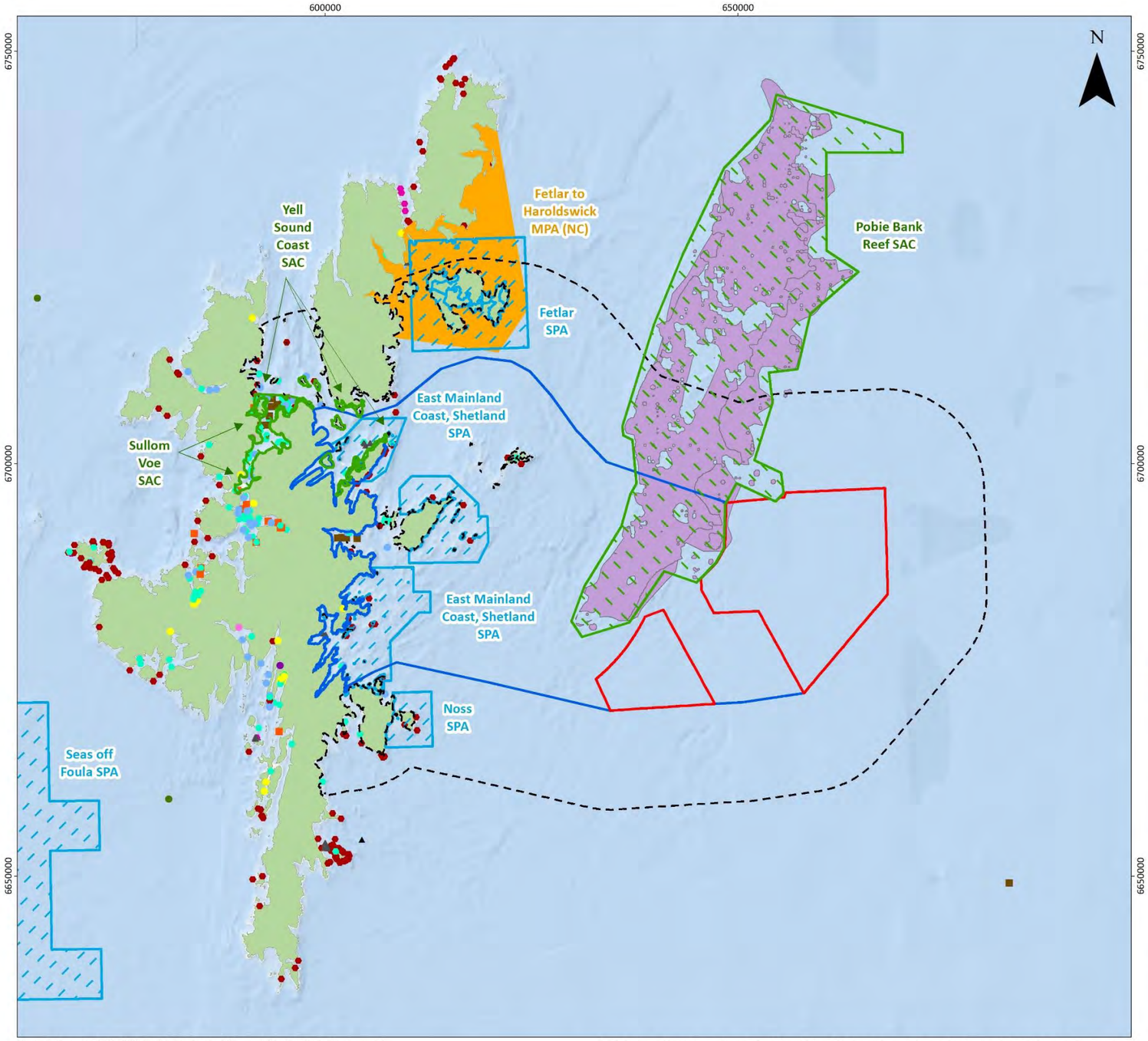
The Yell Sound Coast SAC, East Mainland Coast Shetland SPA and Seas off Foula SPA designated sites all fall within the study area but have no benthic qualifying designated features. However, all three of these sites have conservation objectives that indirectly protect benthic features as a habitat or food source for the primary designated features. The Yell Sound Coast SAC is designated for the protection of harbour seals (*Phoca vitulina*) and sea otter (*Lutra lutra*) with the conservation objectives of this site including the prevention of habitat degradation. These species are discussed in more detail in Chapter 10: Marine Mammals.

The East Mainland Coast Shetland SPA and Seas off Foula SPA are designated for various bird species and the conservation objectives for the sites are to maintain the prey/food source for these designated species.

Qualifying species of the East Mainland Coast Shetland SPA include the Great northern diver (*Gavia immer*) Slavonian grebe (*Podiceps auritus*) and Red-throated diver (*Gavia stellata*) whose prey species include polychaetes, crustaceans, copepods, bivalves, and gastropods (Kleinschmidt *et al.,* 2019). The qualifying features of the Seas off Foula SPA include Artic skua (*Stercorarius parasiticus*) Atlantic puffin (*Fratercula arctica*), Common guillemot (*Uria aalge*), Great skua (*Stercorarius skua*) and Northern fulmar (*Fulmarus glacialis*). The diet of these bird species also includes polychaetes, crustaceans, copepods, bivalves, and gastropods, as well as sandeel (*Ammodytes marinus*) which inhabit the sand benthos within the SPA (Kleinschmidt *et al.,* 2019). This is discussed in further detail in Chapter 11: Offshore Ornithology.

Scottish Ministers identified a list of 81 PMFs in 2014 that were named for their significant role within Scottish marine ecosystems. As discussed in Section 8.5.1, and presented spatially in Figure 8.4there is evidence that PMFs kelp beds, kelp and seaweed communities on sublittoral sediment, maerl beds, horse mussel beds, seagrass beds and burrowed mud are present within the study area, as well as PMF northern sea fan and sponge communities being a designated feature within the Pobie Bank Reef SAC.

Kelp beds form a key part of marine ecosystems throughout Scottish seas, providing food and shelter for fish, invertebrates, and marine mammal species. Coralline algae, also present within the Pobie Reef Bank SAC, often forms on the rocks below the kelp canopy, and this supports fauna such as sponges, sea squirts and sea anemones. Crustaceans and worms will often live on the holdfasts and sea urchins and snails will graze on the kelp itself, whilst fish species will use the kelp to hide from predators. Kelp beds are also a Biodiversity Action Plan (BAP) priority habitat and activities that alter wave exposure or tidal flow can impact kelp beds and the associated ecosystem they create.



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Sites Designated for Nature Conservation and Priority Marine Features

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Sedimentary Zone of Influence
- SACs
- SPAs
- MPA

Priority Marine Features (ScotGov, 2018)

- Blue mussel beds
- Blue mussel beds and Low or variable salinity habitats
- Burrowed mud
- Burrowed mud or Inshore deep mud with burrowing heart urchins
- Horse mussel beds
- Kelp and seaweed communities on sublittoral sediment
- Kelp beds
- Maerl beds
- Maerl or coarse shell gravel with burrowing sea cucumbers
- Seagrass beds
- Tide-swept algal communities and Kelp beds
- Fan Mussels
- Maerl beds and Horse mussel beds (mosaic)
- Northern sea fan and sponge communities

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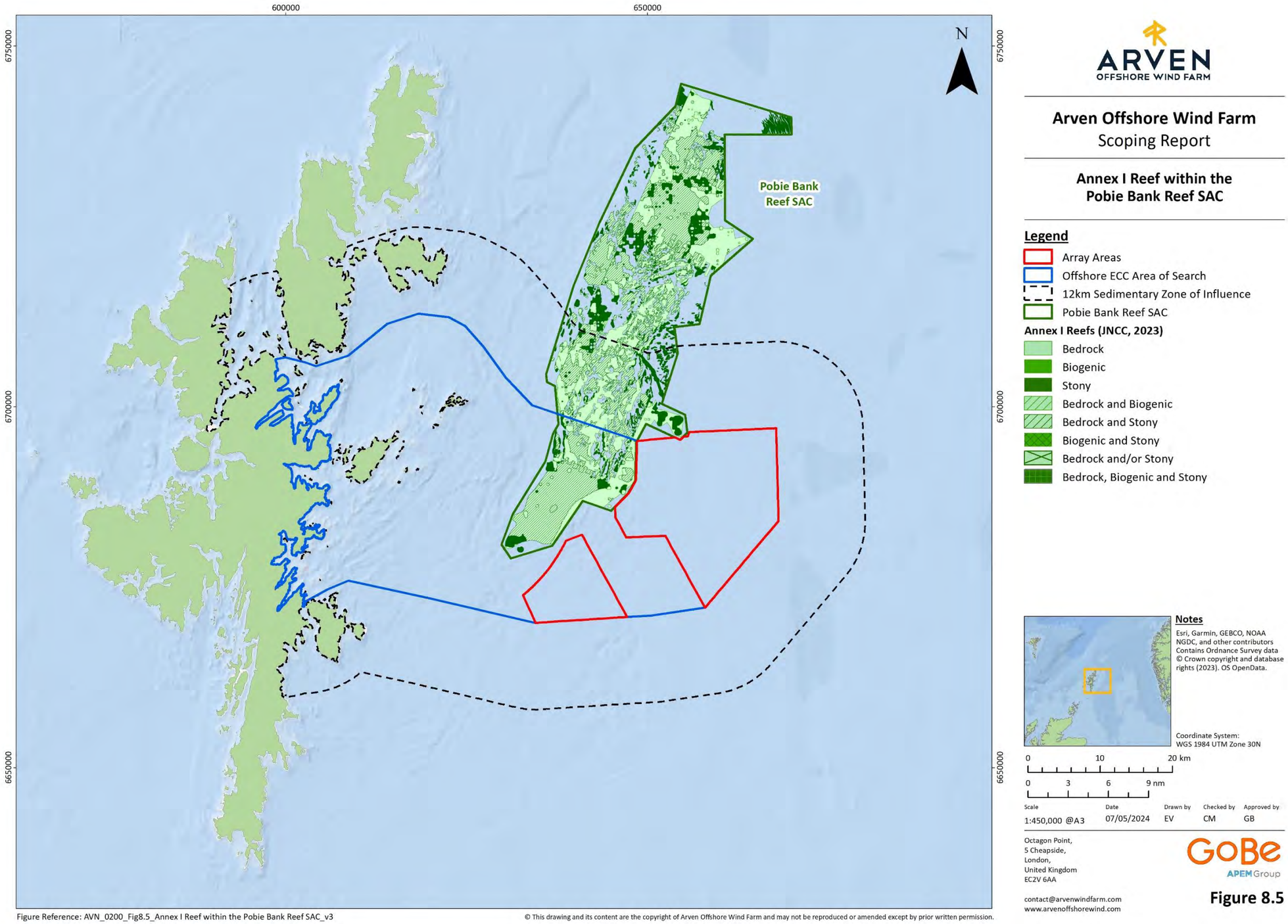
Figure 8.4

Figure Reference: AVN_0200_Fig8.4_Designated Sites and Priority Marine Features_v4

Figure 8.4: Sites Designated for Nature Conservation and Priority Marine Features



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Annex I Reef within the Pobie Bank Reef SAC

Legend

- Array Areas
- Offshore ECC Area of Search
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- Pobie Bank Reef SAC

Annex I Reefs (JNCC, 2023)

- Bedrock
- Biogenic
- Stony
- Bedrock and Biogenic
- Bedrock and Stony
- Biogenic and Stony
- Bedrock and/or Stony
- Bedrock, Biogenic and Stony

Notes

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Figure 8.5

Figure Reference: AVN_0200_Fig8.5_Annex I Reef within the Pobie Bank Reef SAC_v3

Figure 8.5: Annex I Reef within the Pobie Bank Reef SAC (JNCC, 2023).

Table 8.2: Sites designated for nature conservation relative to benthic subtidal and intertidal ecology within the study area

Designated Site	Benthic Qualifying Feature	Conservation Objective
Pobie Bank Reef SAC	• Reefs	• Maintain or restore the feature in/to favourable condition
Sullom Voe SAC	• Large shallow inlets and bays; • Coastal lagoons; • Reefs	• To avoid deterioration; and • To achieve and maintain favourable condition
Fetlar to Haroldswick (NC)MPA	• Circalittoral sand and coarse sediment communities; • Horse mussel beds; and • Kelp and seaweed communities on sublittoral sediment	• To maintain in favourable condition
Yell Sound Coast SAC	• Supporting benthic habitats to protected marine mammal species	• To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and • To ensure for the qualifying species that the distribution and extent of habitats supporting the species are maintained in the long term
East Mainland Coast Shetland SPA	• Supporting benthic habitats to protected bird species	• To ensure that the integrity of the site is maintained in the context of environmental changes by meeting the objective of: The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained
Fetlar SPA	• Supporting benthic habitats to protected bird species	• To avoid deterioration of the habitats qualifying species or significant disturbance to the species, thus insurance that the integrity of the site is maintained; and • To ensure for the qualifying species that the distribution and extent of habitats supporting the species are maintained in the long term

Designated Site	Benthic Qualifying Feature	Conservation Objective
Noss SPA	• Supporting benthic habitats to protected bird species	• To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and • To ensure for the qualifying species that the distribution and extent of habitats supporting the species are maintained in the long term

8.6 Embedded Mitigation

As part of the initial design process, embedded mitigation measures are proposed to reduce the potential environmental effects of development. Measures related to benthic subtidal and intertidal ecology are as follows:

- C-1: Development of and adherence to a CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring;
- C-6: Development of and adherence to an EMP. The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: Chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management;
- C-9: Development of and adherence to a MPCP. The MPCP will identify potential sources of pollution and associated spill response and reporting procedures;
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Offshore Proposed Development;
- C-15: Development of and adherence to a Construction Programme (CoP). The CoP will confirm the timing and duration of the main Offshore Proposed Development construction activities;
- C-17: Development of and adherence to an OMP. The OMP will describe operation and maintenance activities and provide an indicative schedule for the undertaking of these;
- C-20: Scour protection. Where there is the potential for scour to develop around infrastructure (including foundations and cables);
- C-29: Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP; and
- C-32: Suitable implementation and monitoring of cable protection (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible), as detailed within the CaP.

8.7 Scoping of Impacts

This section sets out an initial assessment of the likelihood of effects on benthic subtidal and intertidal ecology due to the Offshore Proposed Development construction, operation, maintenance, and decommissioning activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the Offshore Proposed Development at the scoping stage; the existing evidence base for benthic subtidal and intertidal ecology effects due to the Offshore Proposed Development activities; relevant policy; and the professional judgement of qualified benthic subtidal and intertidal ecologists. The impacts scoped in are presented in Table 8.3, and impacts scoped out at this stage are presented in Table 8.4 below.

8.7.1 Potential Impacts Scoped In

Table 8.3 sets out the potential impacts that are proposed for scoping into the assessment for Benthic, Subtidal and Intertidal Ecology.

Table 8.3: Impacts scoped into the assessment of benthic subtidal and intertidal ecology

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction and Decommissioning			
Increases in SSC and changes to seabed levels	Temporary elevations in SSCs due to construction and decommissioning (i.e., cable installation) activities. This could in turn result in changes to the underlying seabed/coastal bed levels, through deposition of the suspended material and changes to the surficial sediment type.	This assessment will be informed by the worst-case parameters for cable and foundation installation activities during the construction phase, and decommissioning activities. Sediment plume modelling will be undertaken and used to inform the maximum plume extents and sediment deposition.	C-1 (CaP); C-14 (DP); C-15 (CoP); C-29 (Cable Burial); C-32 (Cable Protection)
Temporary habitat disturbance	There is potential for temporary, direct habitat disturbance during construction activities in the Array Areas and along the OfECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring.	This assessment will be informed by the worst case parameters for seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. Area of disturbance will be calculated and assessed in relation to the specific habitat biotopes recorded within the Array Area and along the OfECC (using existing mapping data and site-specific survey data).	C-1 (CaP); C-6 (EMP); C-14 (DP); C-15 (CoP); C-29 (Cable Burial); C-32 (Cable Protection)
Direct and indirect disturbance leading to the release of sediment contaminants	Seabed disturbance during construction and decommissioning phases could lead to the mobilisation of existing sediment contaminants that could have an impact on the benthos. Effects on benthic subtidal and intertidal ecology because	This assessment will be informed by the worst-case parameters for sediment disturbance during the construction and decommissioning phases. The assessment will be informed by site specific surveys undertaken to review intertidal	C-1 (CaP); C-6 (EMP); C-9 (MPCP); C-14 (DP); C-15 (CoP)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments.	and subtidal sediment contamination across the site. These are detailed in Chapter 7: Marine Water & Sediment Quality.	
Permanent and/or long-term habitat loss/alteration due to the removal of infrastructure	Following the decommissioning of the Offshore Proposed Development there is potential for long-term habitat loss or alteration directly associated with the removal of infrastructure.	This assessment will be informed by the worst-case parameters for the physical presence of infrastructure on the seabed. Area of habitat loss / potential alteration will be calculated and assessed in relation to the specific habitat biotopes recorded within the Array Area and along the OfECC (using existing mapping data and site-specific survey data).	C-14 (DP)
Increased risk of introduction and/or spread of Invasive Non-Native Species (INNS)	Increased risk of introduction or spread of Marine INNS due to the presence of the subsea infrastructures and increased vessel movements may facilitate the spread of non-native species and may subsequently impact biodiversity and assemblages of the benthic, subtidal and intertidal ecology of the area.	This assessment will be informed by the worst case parameters for the installed infrastructure during the construction and decommissioning phase. The potential introduction or spread of Marine INNS and subsequent impact to local benthic, subtidal and intertidal ecology receptors will be assessed based on current industry understanding, available literature and expert knowledge. The assessment will take into consideration the mitigation and control of	C-6 (EMP); C-14 (DP); C-15 (CoP).

Impact	Description	Proposed Assessment Approach	Embedded mitigation
		invasive species measures that will be incorporated into the EMP. Consideration of the mitigation and control of invasive species measures in line with International Maritime Organisation (IMO) will be given (IMO, 2019). These standards and procedures will be incorporated into the EMP and are embedded in the project design and as such ensure that no significant effects arise from INNS.	
Operation and Maintenance			
Direct and indirect disturbance leading to the release of sediment contaminants	Seabed disturbance during operation and maintenance phases could lead to the mobilisation of existing sediment contaminants that could have an impact on the benthos. Effects on benthic subtidal and intertidal ecology because of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments.	This assessment will be informed by the worst-case parameters for sediment disturbance during the O&M phase. The assessment will be informed by site specific surveys undertaken to review intertidal and subtidal sediment contamination across the site. These are detailed in Chapter 7: Marine Water & Sediment Quality.	C-1 (CaP); C-6 (EMP); C-9 (MPCP); C-17 (OMP)
Permanent and/or long-term habitat loss/alteration	Following the construction of the Offshore Proposed Development there is potential for long-term habitat loss or alteration directly associated	This assessment will be informed by the worst case parameters for the physical presence of infrastructure on the seabed. Area of habitat loss / potential alteration will be calculated and	C-17 (OMP)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
due to the addition of infrastructure to the area	with the presence of, for example, WTG foundations, scour and cable protection.	assessed in relation to the specific habitat biotopes recorded within the Array Area and along the OfECC (using existing mapping data and site-specific survey data).	
Temporary habitat disturbance	There is the potential for direct habitat disturbance of the seabed during planned and unplanned maintenance (e.g., through the use of jack up vessels or cable repair or replacement).	This assessment will be informed by the worst case parameters for the use of jack up vessels or cable repair or replacement. Area of disturbance will be calculated and assessed in relation to the specific habitat biotopes recorded within the Array Area and along the OfECC (using existing mapping data and site-specific survey data).	C-1 (CaP); C-6 (EMP); C-17 (OMP)
Colonisation of hard substrates	Man-made substructures such as WTG foundations and any associated scour/cable protection on the seabed are expected to be colonised by marine organisms. This colonisation is expected to then result in an increase in local biodiversity and alterations to the near field benthic ecology of the area.	This assessment will be informed by the worst-case parameters for the introduced man-made substructures which are expected to be colonised by marine organisms during the operation and maintenance phase.	C-17 (OMP)
Changes in physical processes resulting from the presence of the Offshore Proposed Development's subsea	With embedded mitigation measures implemented it is unlikely there will be significant impacts to benthic ecology features from changes in physical processes as impacts will be spatially and temporally minimal. Physical processes modelling	This assessment will be informed by the worst-case parameters for the physical presence of infrastructure on the seabed for changes in physical processes, determined by modelling	C-17 (OMP); C-29 (Cable Burial); C-32

Impact	Description	Proposed Assessment Approach	Embedded mitigation
infrastructure e.g., scour effects, changes in wave/ tidal current regimes and resulting effects on sediment transport	of other OWF projects has predicted small, local impacts on benthic communities from disturbances of this nature. However, this impact will be fully assessed.	and assessment. The subsequent impact on benthic ecology features will be assessed.	(Cable Protection)
Electromagnetic Field (EMF) from buried Operational Cables	EMF may impact sensitive species, including elasmobranchs, teleost fish (i.e., flat fish, salmonids and gadoids) and crustaceans (e.g. brown crab) by altering foraging or migratory behaviour. The magnitude of this impact will depend in part on the project design and the burial and cable protection measures which are utilised. For floating foundations, EMF effects will also be considered for suspended cables in the water column.	This assessment will be informed by the worst-case parameters for the presence of cables on the sea floor and the burial and cable protection measures utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column. It is acknowledged that there is limited, but emerging research on EMF impacts on benthic ecology, especially for dynamic cables. The impact assessment will draw on the latest relevant available literature on this impact.	C-1 (CaP); C-17 (OMP); C-29 (Cable Burial); C-32 (Cable Protection)

8.7.2 Potential Impacts Scoped Out

Table 8.4: Impacts proposed to be scoped out of further assessment for benthic subtidal and intertidal ecology

Impact	Justification
Construction and Decommissioning	
Accidental pollution during construction or decommissioning activity	Chemical and oil inventories on vessels working during construction and decommissioning stages will be small in size. In the event of an accidental chemical or oil spill, hydrocarbons would rapidly be dispersed or diluted. As well as this, all vessels on the Offshore Proposed Development will be required to comply with strict environmental controls set out in the EMP (C-6) and the MPCP (C-9) which will minimise the risk and set out provisions for responding to spills during construction or decommissioning. Due to the implementation of control measures and small quantities of hydrocarbons and chemicals it is proposed to scope this impact out of further consideration within the EIA.
Operation and Maintenance	
Accidental pollution events during the operational and maintenance phase	See justification described for accidental pollution events during construction and decommissioning activity above.

8.8 Potential Cumulative Impacts

Chapter 4: EIA Methodology details how potential cumulative impacts will be assessed through the CIA. For benthic subtidal and intertidal ecology, cumulative interactions may occur with other planned OWFs as well as other activities in the study area.

Impacts that are scoped into the assessment for the Offshore Proposed Development alone, are generally spatially restricted to being within close proximity to the Array Areas and OfECC. However, certain potential impacts, such as an increase in SSC, have the potential to affect the benthic subtidal communities over a more significant area. It is proposed that impacts with limited spatial extent, that do not have an effect on a designated species, site, or feature, are scoped out of any further assessment within the CIA in the subsequent EIAR.

For this reason, only the following impact on benthic subtidal and intertidal ecology receptors is being proposed for further consideration within the CIA, subject to route refinement:

- Temporary increase in SSC and sediment deposition.

Further details on the approach to CIA are provided in Chapter 4, Section 4.4 of this Offshore Scoping Report and the specific criteria / relevant projects and plans that will be applied to and considered for the Benthic, Subtidal and Intertidal assessment will be determined as the EIA process continues. This CIA will likely include the Stoura OWF being progressed by ESB Asset Development along with any other relevant marine renewable / oil and gas infrastructure or other marine assets.

8.9 Potential Transboundary Impacts

Transboundary impacts related to benthic and intertidal ecology are not anticipated to arise from construction, O&M or decommissioning stages of the Offshore Proposed Development. Any impacts on benthic and intertidal ecology receptors will be localised in nature and any indirect effects will likely be limited to one tidal excursion from the impact source. The Offshore Proposed Development is a significant distance from the nearest adjacent Exclusive Economic Zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

8.10 Proposed Approach to EIA

This section outlines the proposed EIA approach to the Offshore Proposed Development for benthic and intertidal ecology. This includes the proposed assessment methodology, relevant guidance to be adhered to and anticipated additional data sources to be used at EIA.

8.10.1 Relevant Guidance

In addition to the general legislation, policy and guidance outlined in Chapter 2: Legislation and Policy Context and Chapter 7: Marine Water & Sediment Quality, the assessment of benthic and intertidal ecology receptors will also comply with the following guidance documents where they are specific to this topic:

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial Freshwater, Coastal and Marine (CIEEM, 2018);
- Guidelines for Ecological Impact Assessment in Britain and Ireland. Marine and Coastal. Final Document, August 2010 (CIEEM, 2010);
- Guidance document on wind energy developments and EU nature legislation (European Commission, Directorate-General for Environment, 2021);
- Strategic Review of Offshore Wind Farm Monitoring Data Associated with FEPA 1985 License Conditions (Cefas, 2004);
- Cumulative impact assessment guidelines, guiding principles for cumulative impacts assessments in offshore wind farm (RenewableUK, 2013);
- Guidance note for EIA in respect of FEPA and CPA requirements (Centre for Environment, Fisheries and Aquaculture (Cefas, 2004);
- Marine Scotland Habitats Regulations Appraisal of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Information for Appropriate Assessment (ABPmer, 2011);

- Appropriate Assessment for Sectoral Marine Plan for Offshore Wind Energy (Scottish Government 2020);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Judd, 2012);
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008); and
- Sensitivity of features based upon the Marine Evidence-based Sensitivity Assessment (MarESA) framework where possible (Tyler-Walters *et al.,* 2018).

8.10.2 Anticipated Additional Data Sources at EIA

A thorough, desk-based collation and review of the relevant data will be undertaken to inform the EIA, as well as use of data gathered via site-specific surveys. The desk-based study will include collation of any further data or information that may become available following the completion of the recent benthic survey campaigns undertaken at the Pobie Bank Reef SAC led by JNCC in 2020 and 2023, for which data and findings are yet to be published. Several other JNCC datasets will also be requested from JNCC to assist with informing the EIA (including video and camera sampling and side scan sonar / multibeam echosounder maps).

A site-specific Benthic Ecology Survey Campaign took place across the Array Areas in Q3-Q4 2023. This survey campaign collected site specific data using sediment grabs for the analysis of faunal composition, PSA and sediment contaminants as well as obtaining DDV data. This site-specific survey was conducted to provide an up to date and robust characterisation of the benthic environment at the Offshore Proposed Development. The results of the benthic ecology surveys will be used to characterise and understand the seabed habitat and faunal composition within the Array Areas and the seabed area between the Array Areas.

During the survey, 76 DDV stations were surveyed and 34 grab / PSA samples were collected. Sediment eDNA samples were collected at 9 of the 34 grab stations, which were stored and frozen so that once an efficient and effective method of analysis is agreed, the samples can then be analysed.

A site-specific Benthic Ecology Survey of the refined OfECC will be undertaken to inform EIA.

8.10.3 Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report.

To enable the potential impacts of the Offshore Proposed Development to be assessed, a description of the existing benthic communities, focusing particularly on any areas of conservation interest, will be produced. Potential impacts that may occur on the subtidal and intertidal physical, chemical and biological environment as a result of the planned construction, O&M and decommissioning will then be identified. The sensitivities of the communities present to the types of impact expected from wind farm construction, O&M and decommissioning activities will be assessed. Where necessary, measures will be proposed to mitigate the impacts.

In the event that the Offshore Proposed Development has a direct impact on any sites that are designated for conservation at the European (SAC or SPA; now forming part of the UK's National Site Network) or international level (Ramsar), as a result of qualifying habitats or species that they support, then the requisite

information will be provided alongside the EIA to assist the CA to carry out an AA. It is proposed that a detailed geophysical survey campaign of the Offshore Proposed Development will not be undertaken to inform EIA and that existing side scan sonar / multibeam echosounder (and DDV and camera footage) survey data gathered across Pobie Bank SAC during JNCC-led surveys will be used to support impact assessment. A geophysical survey campaign will however be completed post consent for the Array Areas and refined OfECC to further inform the final design concepts of the Offshore Proposed Development.

Cumulative impacts will be assessed by taking into consideration any other relevant plans or projects proposed or in construction, that are in the vicinity of the study area.

8.11 Scoping Questions

The following scoping questions refer to the benthic subtidal and intertidal ecology chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those data listed in Section 8.3, and any additional anticipated data listed in Section 8.10, being used to inform the Offshore EIA?
- Do you agree with the study area(s) defined for benthic and intertidal ecology?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree with the scoping in and out of impact pathways in relation to benthic and intertidal ecology?
- Do you agree on the suitability of the embedded mitigation measures proposed for benthic, subtidal and intertidal ecology?
- Do consultees have any feedback on the use of sediment eDNA in EIA?
- Do you agree to the scoping out of the assessment of transboundary effects related to benthic and intertidal ecology?
- Do you agree with the scoping in and out of cumulative effects in relation to benthic and intertidal ecology?
- Do you agree with the proposed assessment methodology for benthic and intertidal ecology?
- Is there any specific feedback on the possible offshore export cable routing through Pobie Bank SAC?
- A site-specific geophysical survey campaign is not proposed for completion prior to the consent application being submitted and therefore EIA will be informed by the results of site-specific benthic ecology surveys and existing survey datasets (e.g. those published by JNCC for Pobie Bank SAC). Do you agree that EIA can be robustly undertaken without the need for site-specific geophysical survey data? It is intended that geophysical site-specific survey is undertaken post-consent to inform final design.

9 Fish and Shellfish Ecology

9.1 Introduction

This chapter of the Offshore Scoping Report identifies the fish and shellfish ecological pathways and receptors of relevance to the Offshore Proposed Development, and considers the potential impacts from the construction, O&M, and decommissioning of the Offshore Proposed Development upon fish and shellfish ecology.

This chapter should be read alongside the following chapters:

- Chapter 6: Marine Geology, Oceanography and Physical Process;
- Chapter 8: Benthic Subtidal and Intertidal Ecology;
- Chapter 10: Marine Mammals; and
- Chapter 13: Commercial Fisheries.

This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants.

9.2 Study Area

The fish and shellfish study area is presented spatially in Figure 9.1 and has been defined at three spatial scales. For primary impacts, the study area is the Offshore Proposed Development. For secondary impacts, a wider ZoI has been used, encompassing the area over which suspended sediment might travel following disturbance as a result of the Offshore Proposed Development's activities. This secondary ZoI provides a buffer around the Offshore Proposed Development defined by the mean spring tidal excursion which represents the expected maximum distance that suspended sediments may be transported on a mean spring tide in a flood and /or ebb direction (although most suspended sediments are expected to be deposited much closer to the disturbance activity). The tidal excursion distances surrounding the Array Areas and the OfECC range from 4 to 8 km from the Offshore Proposed Development. Therefore, as a precautionary measure, the secondary ZoI has been defined as a 12 km buffer from the Array Areas and OfECC. This 12km buffer does not, however, extend past the east coast of Shetland to the west coast due to the presence of the Shetland land mass.

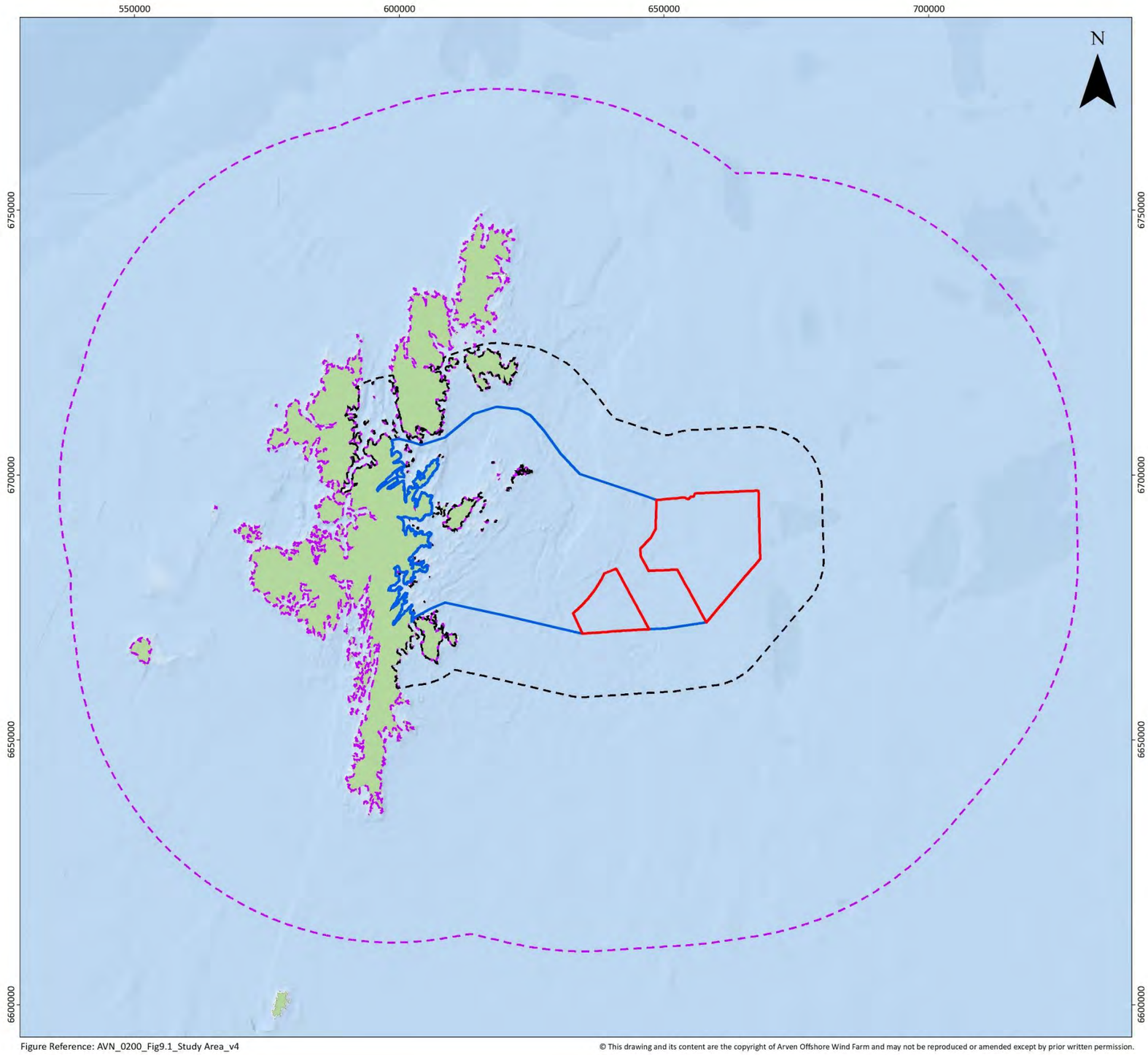
The largest ZoI relates to underwater noise from potential piling in the Array Areas. Until recently, fish were assumed to flee the noise stimulus at a rate of 1.5 m/s, however recent projects have been advised to also consider stationary receptor modelling for some species groups. The maximum impact ranges for both stationary (e.g., spawning herring *Clupea harengus*) and fleeing receptors from recent OWF applications have been presented in Table 9.1 below. Taking the maximum impact ranges as informed by underwater noise modelling for recent OWF projects, a 60 km ZoI for underwater noise impacts is deemed suitably precautionary for the Offshore Proposed Development. The underwater noise ZoI is shown in Figure 9.1.

The study area may be refined as required at post-scoping stages to reflect expected sediment plume behaviour or mapping (or modelling outputs if completed) that will be determined as part of the marine and coastal processes assessments, as well as in response to stakeholder consultation and refinements to the Offshore Proposed Development's design. The study areas for the underwater noise element of the EIAR will

also be defined based on site-specific underwater noise modelling to account for potential impacts from noise, which will be considered in relation to the species and habitats found throughout the study area and wider biogeographic region and data available on the spawning and nursery grounds within this area.

Table 9.1: Impact ranges from Underwater Noise Modelling for recent offshore wind applications

Project	**Maximum impact range for a fleeing receptor**	**Maximum impact range for a stationary receptor**
Awel y Mor OWF (RWE, 2002)	17 km	36 km
Sherringham Shoal and Dudgeon OWF Extension Projects (Equinor, 2022)	10 km	19 km
Hornsea Four OWF (Orsted, 2021)	26 km	38 km
Norfolk Boreas (Vattenfall, 2019)	6.5 km	18 km
West of Orkney OWF (2023)	33 km	52 km



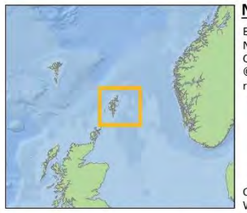
ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

Fish and Shellfish Ecology Study Area

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence



Notes

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System:
WGS 1984 UTM Zone 30N

0 25 50 km

0 5 10 nm

Scale	Date	Drawn by	Checked by	Approved by
1:700,000 @A3	06/03/2024	EV	CM	GB

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APEM Group

Figure 9.1

Figure 9.1: Fish and Shellfish Ecology Study Area

9.3 Data Sources at Scoping

The data sources that have been used to inform this chapter of the Offshore Scoping Report are presented within Table 9.2. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data that will be collected for the Offshore Proposed Development.

Table 9.2: Data sources used to inform the Fish and Shellfish Ecology scoping chapter

Title	Summary	Source	Author and year
Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones) and Spawning and nursery grounds of selected fish species in UK waters	Distribution of North Sea fish and/or shellfish species' spawning and nursery grounds using various survey data	Cefas https://www.cefas.co.uk/publications/techrep/techrep147.pdf	Ellis *et al.*, (2010; 2012)
Fisheries Sensitivity Maps in British Waters	Distribution of North Sea fish and/or shellfish species' spawning and nursery grounds using various survey data	Cefas	Coull *et al.*, (1998)
Developing Essential Fish Habitat Maps for fish and shellfish species in Scotland	Essential fish habitat modelling and mapping for 29 species of fish in order to obtain an evidence base to inform future planning and project level assessments.	https://www.gov.scot/publications/developing-essential-fish-habitat-maps-fish-shellfish-species-scotland-report/	Franco et. al. (2022)
ICES North Sea International Bottom Trawl Survey (NSIBTS)	Data of the species caught during beam trawl surveys.	ICES Data Portal https://data.ices.dk/	ICES, 2018 – 2023

Title	Summary	Source	Author and year
MMO Landings data	Information on landings of the UK fishing fleet, and the status of commercial fish stocks.	https://www.gov.uk/government/collections/uk-sea-fisheries-annual-statistics	MMO, 2018 - 2022
EMODnet broad scale seabed habitat map for Europe (EUSeaMap)	EUSeaMap is a predictive habitat map covering the North Sea. Habitats are described in the EUNIS-2019 classification system.	European Marine Observation and Data Network (ENODnet) https://emodnet.ec.europa.eu/en/euseamap-2021-emodnet-broad-scale-seabed-habitat-map-europe	EMODnet (2021)
Fisheries datasets available from the NMPi, including ScotMap data.	An interactive map providing a data overview of the Scottish marine environment.	MarineScotland https://marinescotland.atkinsgeospatial.com/nmpi/	NMPi (2023)
BGS Marine Sediment Particle Size dataset	National PSA dataset.	BGS https://www.data.gov.uk/dataset/5c623a5e-66d9-4014-a7eb-dbb431bf2c72/marine-sediment-particle-size-data-from-around-the-uk-1966-onwards	BGS (2024)
Updating Fisheries Sensitivity Maps in British Waters	An update to the fish spawning and nursery grounds as mapped by Coull *et al.,* 1998, to provide accurate spatial information.	MarineScotland https://data.marine.gov.scot/dataset/updating-fisheries-sensitivity-maps-british-waters	Gonzalez-Irusta (2014, 2016 & 2017)
Overview of annual Shetland Inshore Fish Survey (SIFS) data (2011-2022):	An overview of results from the Shetland Inshore Fish Survey conducted by UHI Shetland from 2011 - 2022 in the coastal waters around Shetland: catch rates and	https://pureadmin.uhi.ac.uk/ws/portalfiles/portal/29741097/Fraser_et_al._2022._Overview_of_SIFS_data.pdf	Fraser *et al.*

Title	Summary	Source	Author and year
	size compositions of commercial demersal fish species		
Site Specific Surveys			
Benthic Subtidal and Intertidal Ecology Survey Campaign(Array Areas)	Benthic DDV, grab sampling, contaminants and PSA survey to characterise the benthic environment and habitat suitability for substrate dependent spawning fish species (e.g., herring and sandeel). Includes collection and laboratory analysis of eDNA samples.	Held by the Developer	Ocean Ecology Ltd (2023)

9.4 Pre-Scoping Engagement

A pre-scoping consultation workshop was held with MD-LOT, MD-SEDD, NatureScot, SIC and UHI Shetland in November 2023 to present a summary of the existing baseline conditions and data sources used to establish this baseline, alongside providing a summary of the potential impacts proposed for scoping in and scoping out of the fish and shellfish ecology EIA. During the meeting MD-LOT and NatureScot provided the following feedback:

- NatureScot advised of Flapper skate (Dipturus intermedius) tagging data available via UHI Shetland to inform the baseline;
- MD-LOT provided a link to a recently published project on fish / shellfish habitats entitled 'Developing Essential Fish Habitat Maps for fish and shellfish species in Scotland' (Franco et. al., 2022) (Listed in Table 9.2 and used to inform the baseline characterisation);
- NatureScot queried the classification of basking shark within the 'migratory species' group and whether better considered under marine mammals or fish and shellfish ecology (now included under fish and shellfish ecology, given classification of basking shark as elasmobranch species for underwater noise modelling purposes);
- MD-LOT will need to see results of survey/analysis of existing baseline data and further justification for no survey before confirming that no fish trawl surveys will be required to inform EIA;
- NatureScot/ MD-LOT stated that it is too early to scope out underwater noise during O&M;
- NatureScot requested clarification on EMF and whether, in addition to a desk-based study, there will be any modelling on the effects of the cables being done given floating nature of cables; and
- No guidance was available in relation to the approach to analysis of eDNA samples or use in EIA though subsequent engagement with NatureScot has confirmed their expectation that eDNA samples should be processed and analysed to inform the EIA baseline; this analysis is underway.

No other comments were provided with regards to the proposed scoping content of this chapter or the proposed approach to underwater noise modelling.

9.5 Baseline Environment

This characterisation of the species found within the fish and shellfish ecology study area has been completed by drawing upon wider information from publicly available sources. These key sources include the International Council for the Exploration of the Seas (ICES) survey data, collected within the study area and MMO fisheries data reported from nearby ports. Data from these sources have been drawn upon to inform this chapter, to formulate a clear understanding of the fish and shellfish species that can be found within the study area.

9.5.1 Species Present

Bottom trawl surveys were undertaken throughout the greater North Sea, inclusive of the study area, in years 2018 to 2022 as part of the North Sea International Bottom Trawl Survey (NSIBTS). In 2023 the NSIBTS identified an assemblage that predominantly consisted of herring, whiting (*Merlangius merlangus*), haddock (*Melanogrammus aeglefinus*), Norway pout (*Trisopterus esmarkii*), and plaice (*Hippoglossoides platessoides*). The survey recorded several species of conservation importance, notably; cod (*Gadus morhua*), poor cod (*Trisopterus minutus*) and Nephrops (*Nephrops norvegicus*) - all of which are PMFs. Elasmobranch species were also recorded within the surveys, which included cuckoo ray (*Leucoraja naevus*), shagreen ray (*Leucoraja fullonica*), small spotted catshark (*Scyliorhinus canicula*) and critically endangered flapper skate (*Dipturus intermedius*), all of which are on the OSPAR list of Threatened and Declining species due to their removal as both target and non-target species (Marine Scotland, 2020).

Previous NSIBTS collected in years 2022, 2021 and 2020 all recorded similar species assemblages as those in 2023. This data shows that within the area the surveys consistently recorded assemblages predominantly comprising haddock, Norway pout, herring, whiting, mackerel (*Scombrus scombrus)*, plaice and grey gurnard (*Eutrigla gurnardus*).

9.5.2 Species of Commercial Importance

The Array Areas of the Offshore Proposed Development as shown in Figure 13.1 (Chapter 13: Commercial Fisheries), are located in ICES rectangles 49E9, and 49F0. The OfECC overlaps with ICES rectangles 49E9, 49E8 and 50E9. As detailed in Chapter 13: Commercial Fisheries, pelagic species dominate the landings between 2018 – 2022 with lower amounts of demersal and shellfish landings. The key species within the Offshore Proposed Development are mackerel, cod, herring, haddock and whiting. Mackerel are by far the highest value fishery and the key targeted pelagic species in 2018 - 2022, with landings of herring and cod following in value (Chapter 13, Figure 13.2). Mackerel is largely targeted seasonally between October and November, with herring being targeted mostly during July and August.

The key demersal targeted fish species include: haddock, cod, whiting, monkfish (*Lophius piscatorius*) and hake (*Merluccius merluccius),* with saithe *(Pollachius virens),* ling *(Molva molva)* and megrim *(Lepidorhombus whiffiagonis)* also landed in limited amounts. The landings for the key species occur throughout the year, with peaks in autumn and winter months. Top targeted shellfish species include: king scallop (*Pecten maximus*), velvet crab (*Necora puber*), brown crab (*Cancer pagurus*), whelk (*Buccinum udatum*) and lobster.

9.5.3 Spawning and Nursery Grounds

Spawning and nursery grounds of several fish species are known to be located within, or in close proximity to the study area (Figure 9.2, Figure 9.3, Figure 9.4, Figure 9.6, Figure 9.7, Figure 9.8 and Figure 9.9; Coull *et al.,*1998; Ellis *et al.,* 2010; 2012).

A recent essential fish habitat modelling exercise was completed for 29 species of fish and shellfish with the objective of obtaining an evidence base to inform future planning and project level assessments (Franco *et. al*., 2022). The outcomes of this study are a series of maps providing an integrated view of the distribution of the species and their potential essential habitats in Scottish/UK waters. A brief review shows that there is a high to low confidence for potential spawning aggregations for species such as cod, Norway pout and blue whiting. The mapping identifies historic spawning grounds for herring to the west of Shetland as well as more recent spawning grounds further to the south between 1980 and 2000. There is high to low confidence for spawning mackerel, whiting, haddock, hake, Norway lobster, sprat (*Sprattus sprattus*), lemon sole (*Microstomus kitt*) and angler fish (*Lophius piscatorius*) to the east and south east of the Shetland islands.

9.5.3.1 Spawning Grounds

Spawning grounds for sandeel, haddock, saithe, lemon sole, Norway pout, cod and whiting overlap with both the Array Areas and OfECC (Figure 9.2, Figure 9.3 and Figure 9.4). Spawning grounds for nephrops, plaice, sprat and herring do not immediately interact with the Array Areas or OfECC but fall within the study area (Figure 9.3 and Figure 9.4; Coull *et al.,* 1998; Ellis *et al.,* 2010; 2012).

Low intensity spawning grounds for sandeel are present throughout the majority of the study area (Coull *et al.,* 1998; Ellis *et al.,* 2010; 2012). Sandeel are of relevance when considering impacts to spawning areas as they are demersal spawners that lay their eggs onto or into seabed sediments; they also exhibit substrate dependency, preferring sandy substrates on which to spawn. The sediments across the study area predominantly consist of circalittoral rock and deep circalittoral sand, with the deep circalittoral sand dominating the Array Areas, which is suitable for sandeel spawning (EUSeaMap, 2021; Figure 9.5). Sandeel spawning grounds are known to extend across much of the North Sea, and therefore, the impacts are not expected to be of significance (Coull *et al.,* 1998; Ellis *et al.,* 2010; 2012).

The study area overlaps with both low and high intensity cod spawning areas (with spawning occurring in winter; Coull *et al.,* 1998; Ellis *et al.,* 2010; 2012). More recent mapping of spawning and nursery grounds also indicates the presence of cod nursery grounds within the Array Areas (González-Irusta *et al.,* 2014 & 2016). Cod are a particularly relevant receptor due to their sensitivity to underwater noise (cod possess a swim bladder which interacts with their hearing system). In addition, cod exhibits substrate dependency during spawning, with a preference for coarse sands. Figure 9.5 demonstrates that the Array Areas is dominated by deep circalittoral sand, which is suitable for the sediment preference of cod. Within areas of suitable substrates, males identify small territories (known as leks) that they subsequently defend from other males (González-Irusta and Wright, 2016; Grabowski *et al.,* 2009; Nordeide and Folstad, 2000; Scottish Government, 2022). A more detailed description of the sediment types across the study area is discussed in Chapter 8: Benthic Subtidal and Intertidal Ecology. Post-construction monitoring of spawning cod at Beatrice has been undertaken in 2021 and compared to similar pre-construction monitoring previously completed (Beatrice Offshore Wind

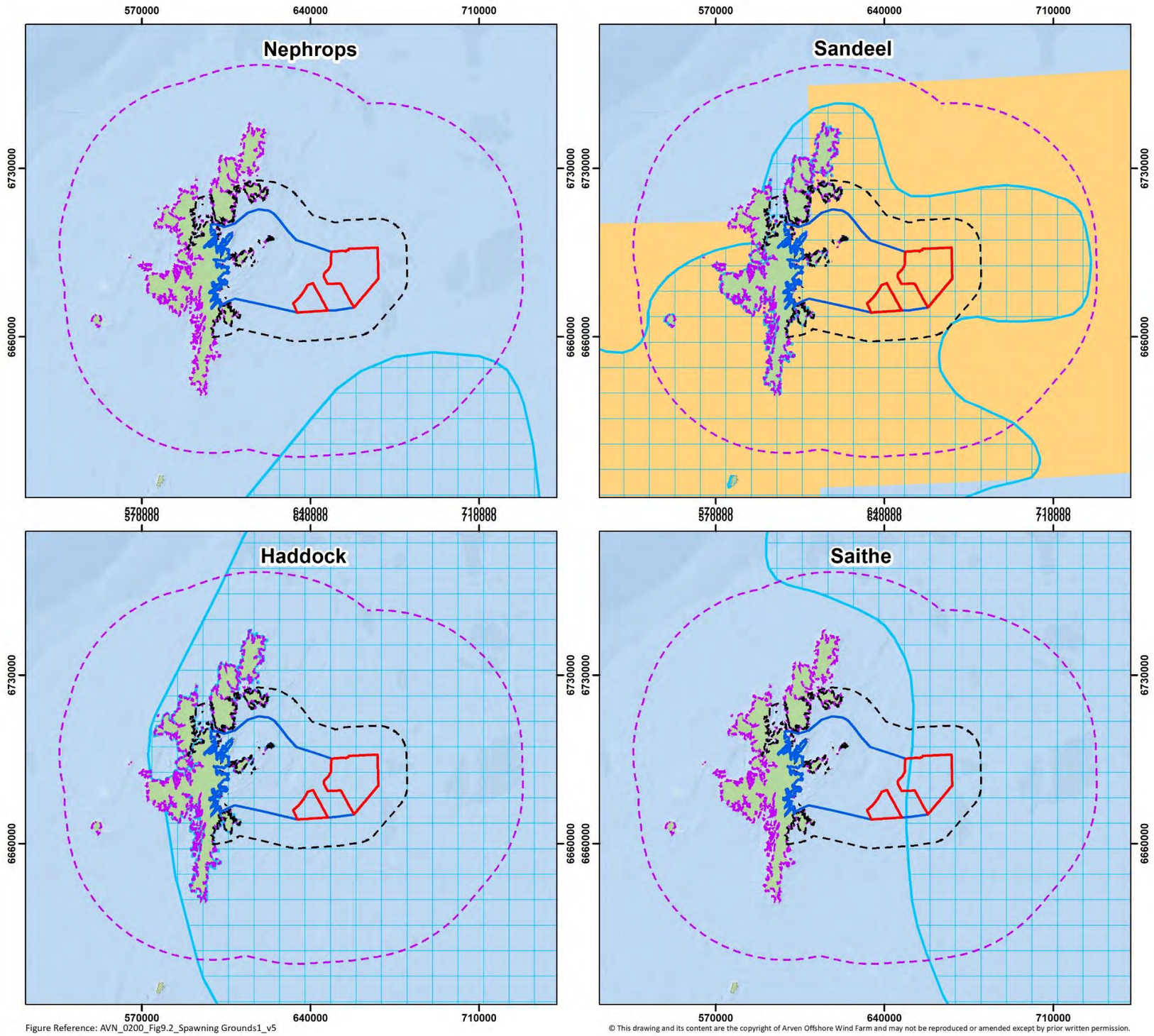
Limited, 2021). This study provided high resolution information on cod spawning in the central Moray Firth and reported that cod spawning was low but was taking place both before and after construction of the offshore wind farm. No clear pattern with regard to spawning locations was apparent.

Herring spawning grounds are located to the southwest of the Offshore Proposed Development and to the west of the Shetland Islands. This falls within the underwater noise ZoI, covering the western side of the Shetland Islands (Coull *et al.,* 1998; Ellis *et al.,* 2012; 2012; Figure 9.4). Herring are demersal spawners that lay their eggs onto or into seabed sediments, they also exhibit substrate dependency, with a preference for gravelly substrates on which to spawn. Furthermore, herring are also particularly sensitive to noise impacts as they have swim bladders which are involved in hearing (Popper *et al.,* 2014).

9.5.3.2 Nursery Grounds

The study area also coincides with high intensity nursery grounds for blue whiting, mackerel and anglerfish and low intensity nursery grounds for species including cod, sandeel, whiting, ling, spurdog, common skate, spotted ray and herring (Ellis *et al.,* 2010; 2012) (as presented within Figure 9.6, Figure 9.7, Figure 9.8 and Figure 9.9). Norway pout, haddock, saithe and lemon sole also have nursery grounds with undetermined intensities within the study area, all of which overlap with both the Array Areas and OfECC, with the exception of saithe which only overlaps the OfECC (Coull *et al.,* 1998; Ellis *et al.,* 2010; 2012) (Figure 9.8 and).

In a broader context, the study area has a spatially limited interaction with a small portion of the overall spawning sites and nursery grounds for these species. The spawning and nursery grounds of the species that overlap the study area form part of far greater spawning and nursery grounds within the North Sea system. Therefore, any impacts from the Offshore Proposed Development are expected to be of lesser significance.



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Spawning Grounds Relative to the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence

Spawning Grounds (Coull et al., 1998) - Intensity

- Higher
- Lower
- Undetermined

Spawning Grounds (Ellis et al., 2010; 2012) - Intensity

- Higher
- Lower

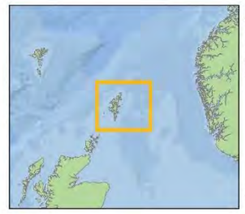

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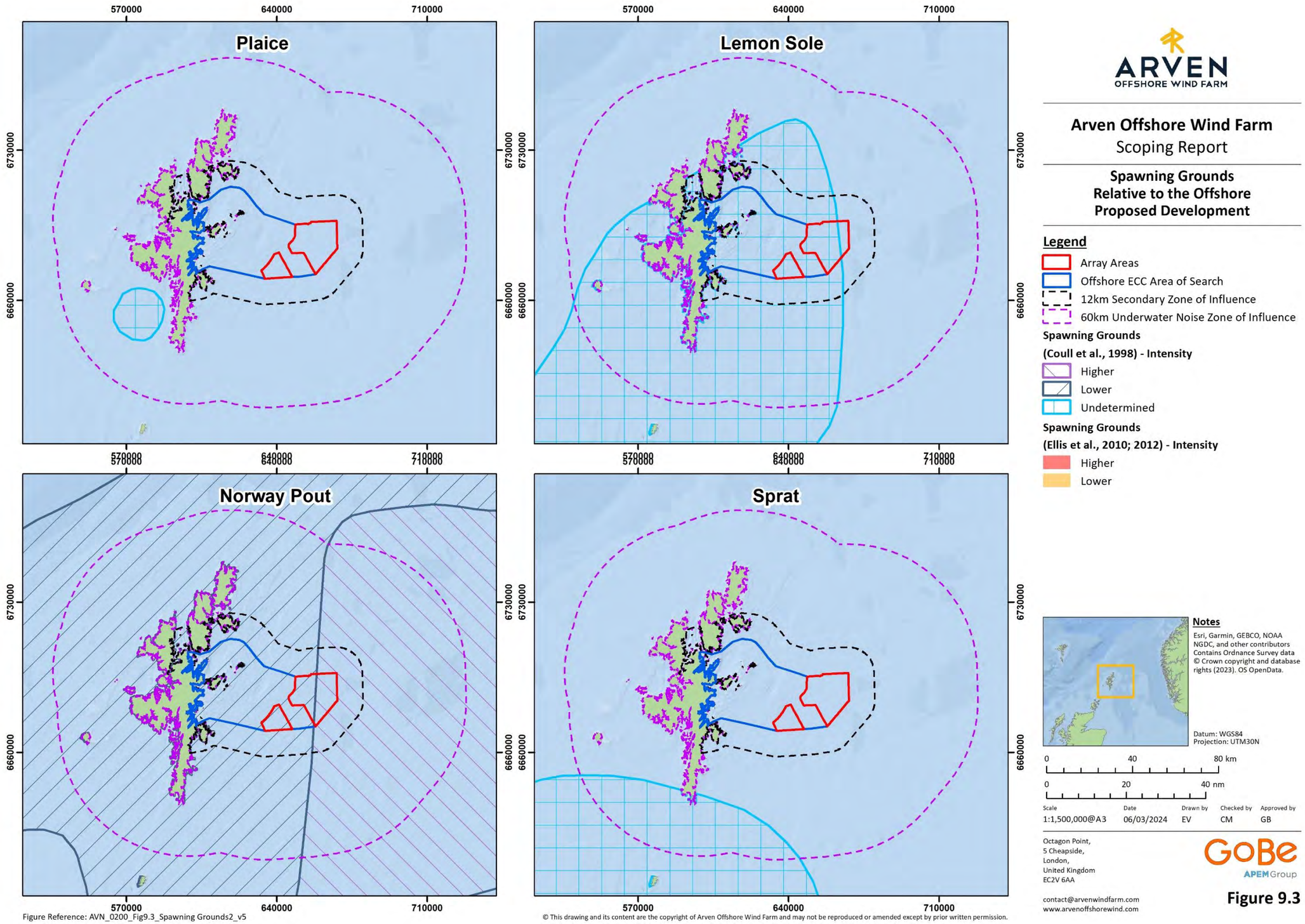
Figure 9.2

Figure Reference: AVN_0200_Fig9.2_Spawning Grounds1_v5

Figure 9.2: Spawning Grounds Relative to the Offshore Proposed Development



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Spawning Grounds Relative to the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence

Spawning Grounds (Coull et al., 1998) - Intensity

- Higher
- Lower
- Undetermined

Spawning Grounds (Ellis et al., 2010; 2012) - Intensity

- Higher
- Lower

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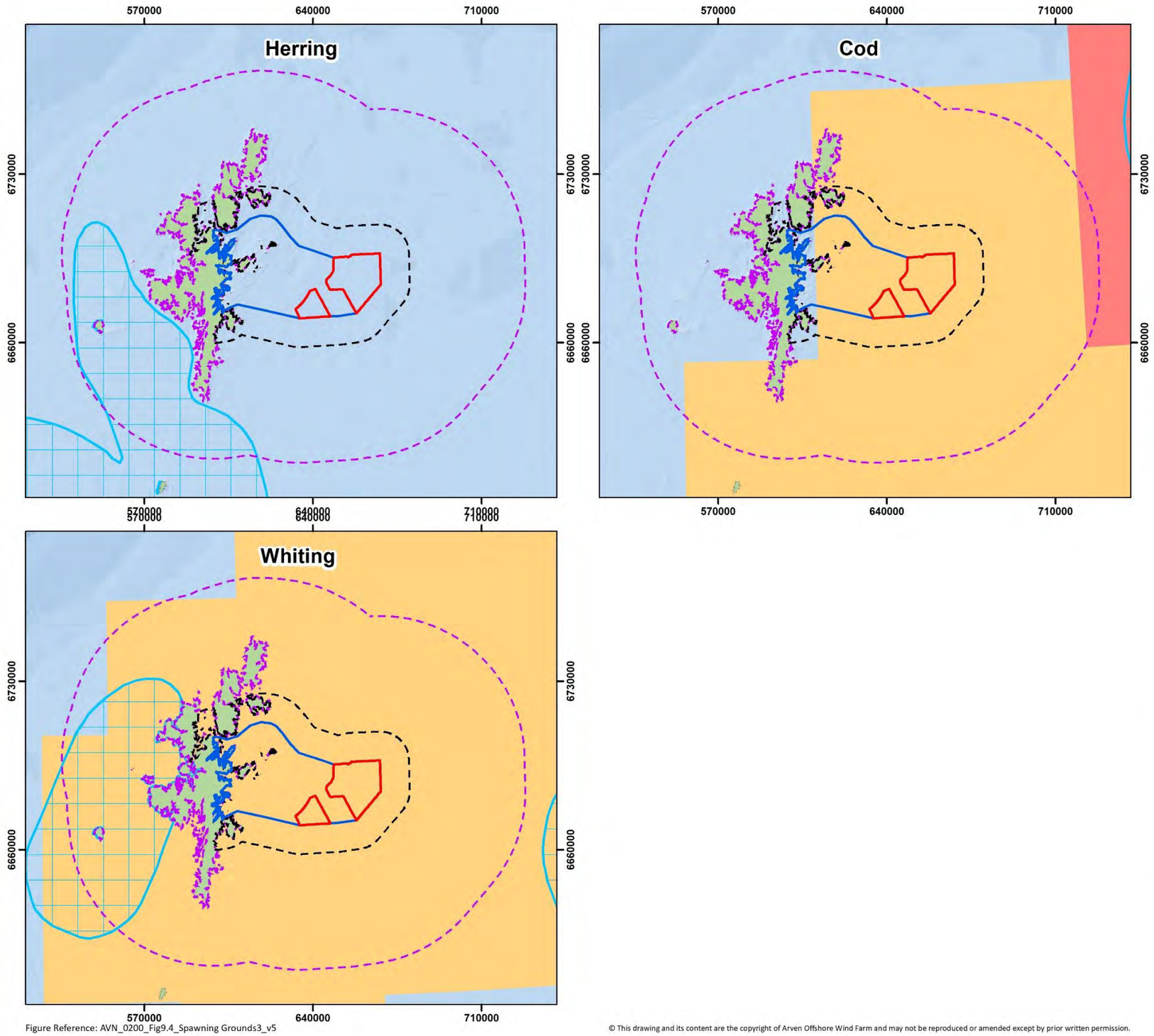
Figure 9.3

Figure Reference: AVN_0200_Fig9.3_Spawning Grounds2_v5

Figure 9.3: Spawning Grounds Relative to the Offshore Proposed Development



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Spawning Grounds Relative to the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence

Spawning Grounds (Coull et al., 1998) - Intensity

- Higher
- Lower
- Undetermined

Spawning Grounds (Ellis et al., 2010; 2012) - Intensity

- Higher
- Lower

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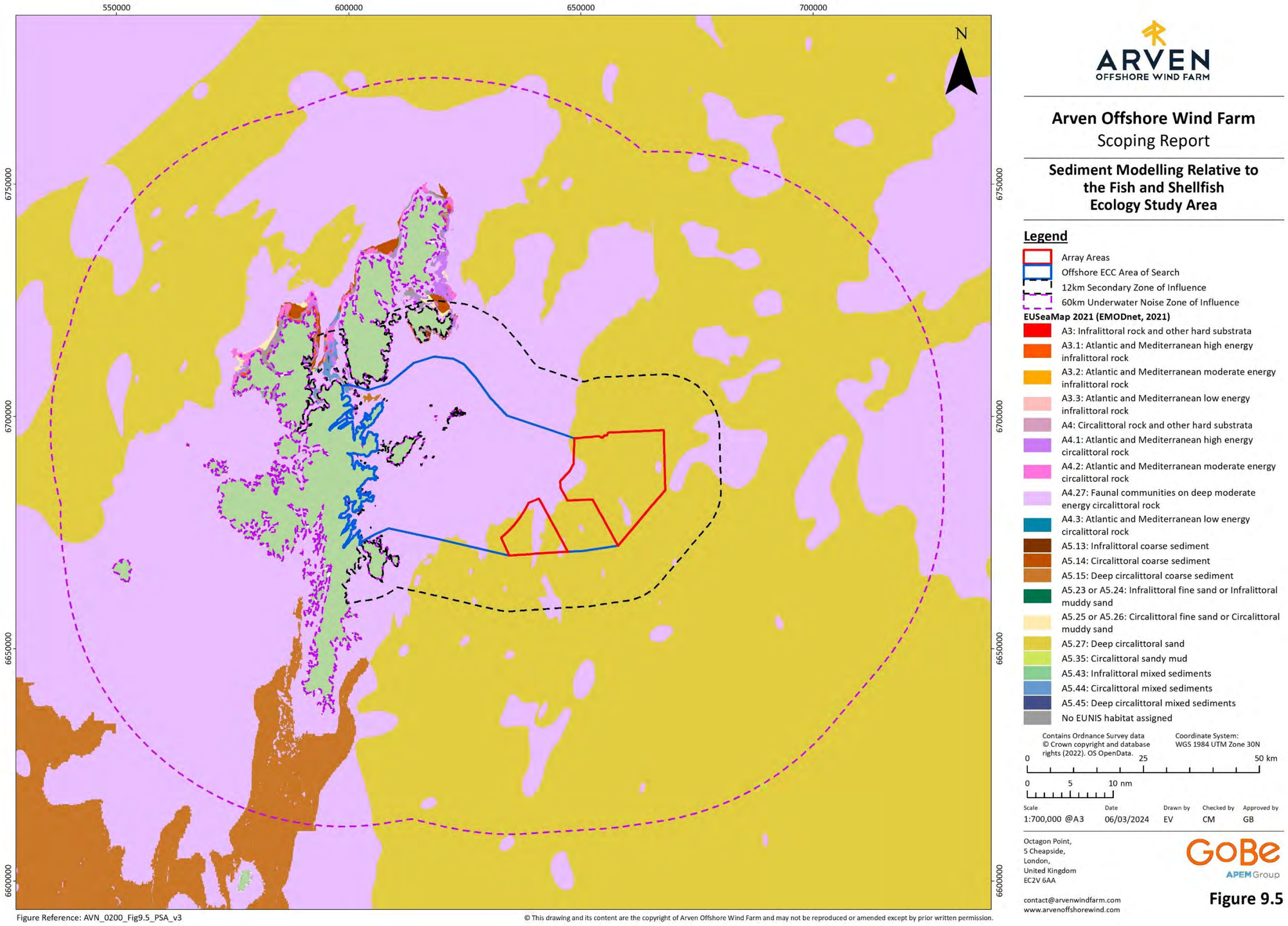
Figure 9.4

Figure Reference: AVN_0200_Fig9.4_Spawning Grounds3_v5

Figure 9.4: Spawning Grounds Relative to the Offshore Proposed Development



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Sediment Modelling Relative to the Fish and Shellfish Ecology Study Area

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence

EUSeaMap 2021 (EMODnet, 2021)

- A3: Infralittoral rock and other hard substrata
- A3.1: Atlantic and Mediterranean high energy infralittoral rock
- A3.2: Atlantic and Mediterranean moderate energy infralittoral rock
- A3.3: Atlantic and Mediterranean low energy infralittoral rock
- A4: Circalittoral rock and other hard substrata
- A4.1: Atlantic and Mediterranean high energy circalittoral rock
- A4.2: Atlantic and Mediterranean moderate energy circalittoral rock
- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.3: Atlantic and Mediterranean low energy circalittoral rock
- A5.13: Infralittoral coarse sediment
- A5.14: Circalittoral coarse sediment
- A5.15: Deep circalittoral coarse sediment
- A5.23 or A5.24: Infralittoral fine sand or Infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand
- A5.27: Deep circalittoral sand
- A5.35: Circalittoral sandy mud
- A5.43: Infralittoral mixed sediments
- A5.44: Circalittoral mixed sediments
- A5.45: Deep circalittoral mixed sediments
- No EUNIS habitat assigned

Coordinate System: WGS 1984 UTM Zone 30N

0 25 50 km

0 5 10 nm

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Figure 9.5

Figure Reference: AVN_0200_Fig9.5_PSA_v3

Figure 9.5: Sediment Modelling Relative to the Fish and Shellfish Ecology Study Area

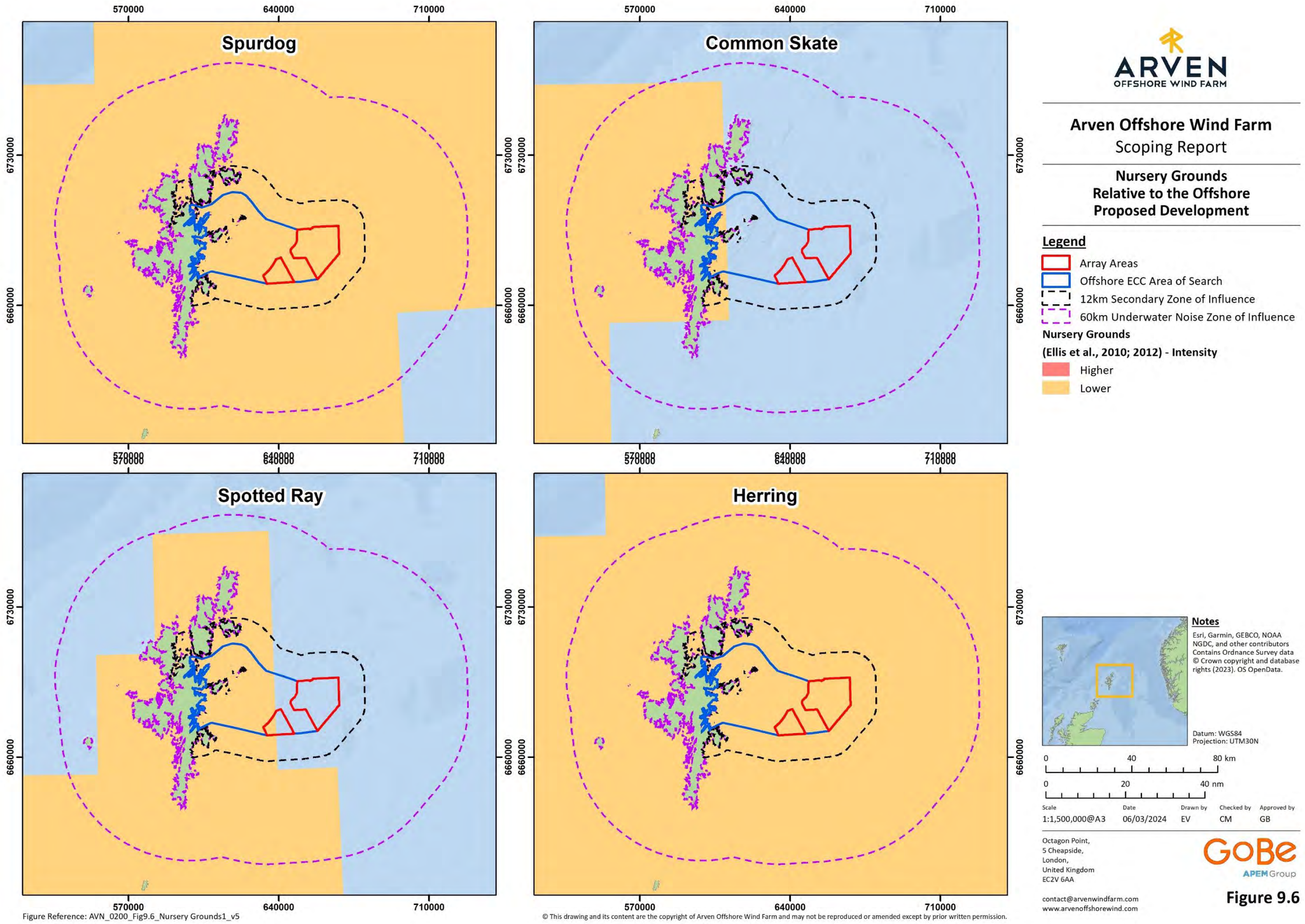
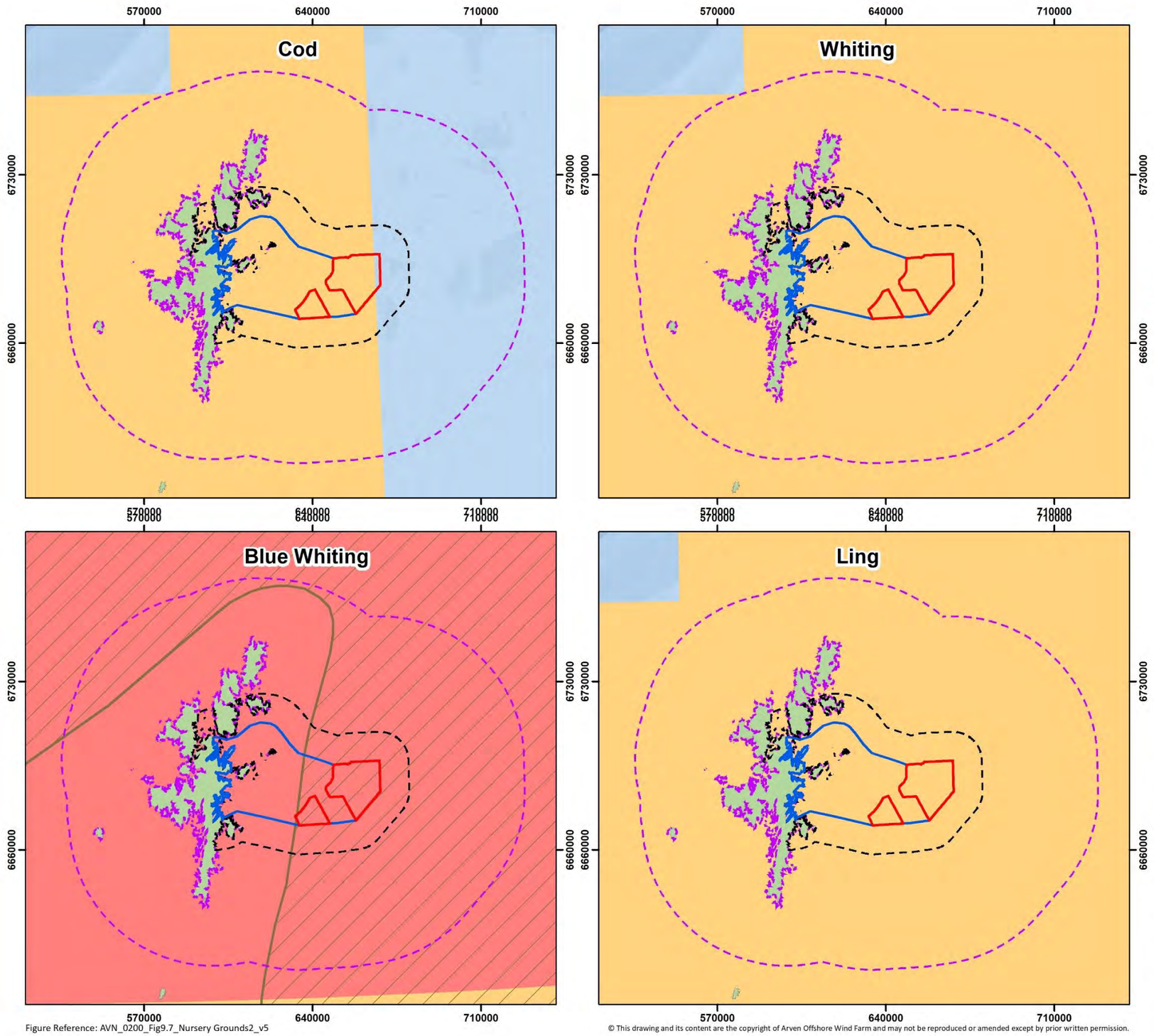


Figure Reference: AVN_0200_Fig9.6_Nursery Grounds1_v5

Figure 9.6: Nursery Grounds Relative to the Offshore Proposed Development



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Nursery Grounds Relative to the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence
- Nursery Grounds (Coull *et al.*, 1998)

Nursery Grounds (Ellis et al., 2010; 2012) - Intensity

- Higher
- Lower

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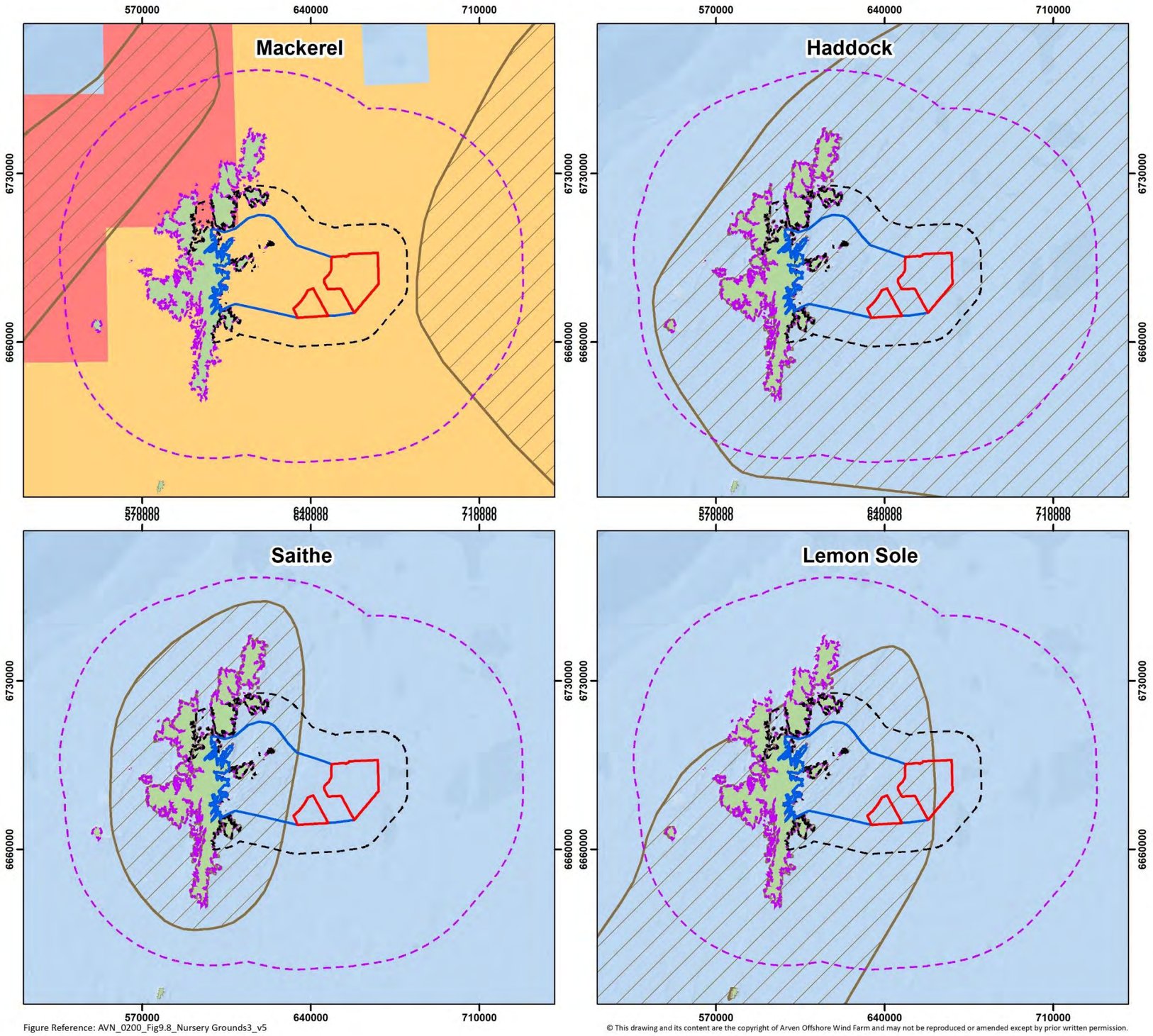
Figure 9.7

Figure Reference: AVN_0200_Fig9.7_Nursery Grounds2_v5

Figure 9.7: Nursery Grounds Relative to the Offshore Proposed Development



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Nursery Grounds Relative to the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence
- Nursery Grounds (Coull *et al.*, 1998)

Nursery Grounds (Ellis et al., 2010; 2012) - Intensity

- Higher
- Lower

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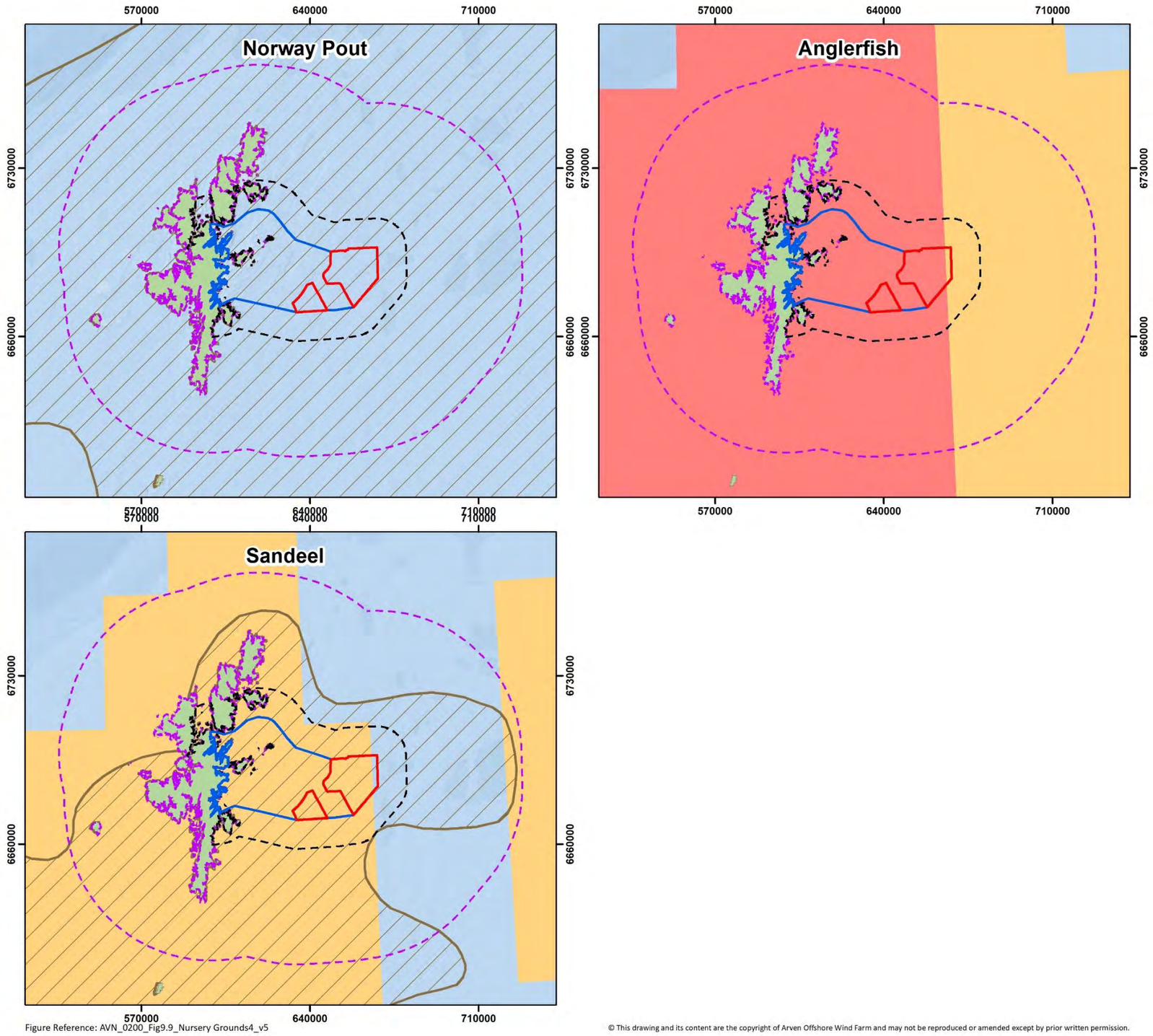
Figure 9.8

Figure Reference: AVN_0200_Fig9.8_Nursery Grounds3_v5

Figure 9.8: Nursery Grounds Relative to the Offshore Proposed Development



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Nursery Grounds Relative to the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence
- Nursery Grounds (Coull *et al.*, 1998)

Nursery Grounds (Ellis et al., 2010; 2012) - Intensity

- Higher
- Lower

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Figure 9.9

Figure Reference: AVN_0200_Fig9.9_Nursery Grounds4_v5

Figure 9.9: Nursery Grounds Relative to the Offshore Proposed Development

9.5.4 Species of Conservation Importance

Within Scottish waters, there are records of several marine and estuarine species protected under national, European and international legislation.

Species of conservation importance that have the potential to be present within the fish and shellfish ecology study area are listed below in Table 9.3 alongside their associated designation.

On account of the conservation importance of these species to the region, all species are considered sensitive receptors to the Offshore Proposed Development and, therefore, potential impacts on these species from the Offshore Proposed Development will be taken into consideration in the fish and shellfish ecology assessment.

Table 9.3: Fish and shellfish species that are protected or considered threatened/declining, which are potentially present within the fish and shellfish ecology study area.

Fish and Shellfish Species	
OSPAR List of threatened and/or endangered species	
• Allis shad; • Atlantic salmon; • Cod; • European eel; • Basking shark; • Spurdog; • Spotted ray; • Thornback ray;	• Greenland halibut *Reinhardtius hippoglossoides;* • Sea lamprey; • Gulper Shark *Centrophorus granulosus*; • Leafscale gulper shark *Centrophorus squamosus*; • Porbeagle *Lamna nasus*; • Portuguese dogfish *Centroscymnus coelolepi;* • Common skate *Dipturus batis*; and • White skate *Dipturus alba*.
UK Post-2010 Biodiversity Framework Priority Species	
• Allis shad; • Anglerfish; • Atlantic halibut; • Basking shark; • Blue ling *Molva dipterygia*; • Blue shark *Prionace glauca*; • Cod; • Common skate; • European eel • Greenland halibut; • Gulper Shark; • Hake; • Horse mackerel; • Leafscale gulper shark; • Lesser sandeel;	• Ling; • Mackerel; • Plaice; • Porbeagle; • Portuguese dogfish; • Raitt's sandeel; • Sandy ray *Leucoraja circularis*; • Sea trout; • Smelt; • Spurdog; • Tope; • Twaite shad *Alosa fallax*; • White skate; and • Whiting.

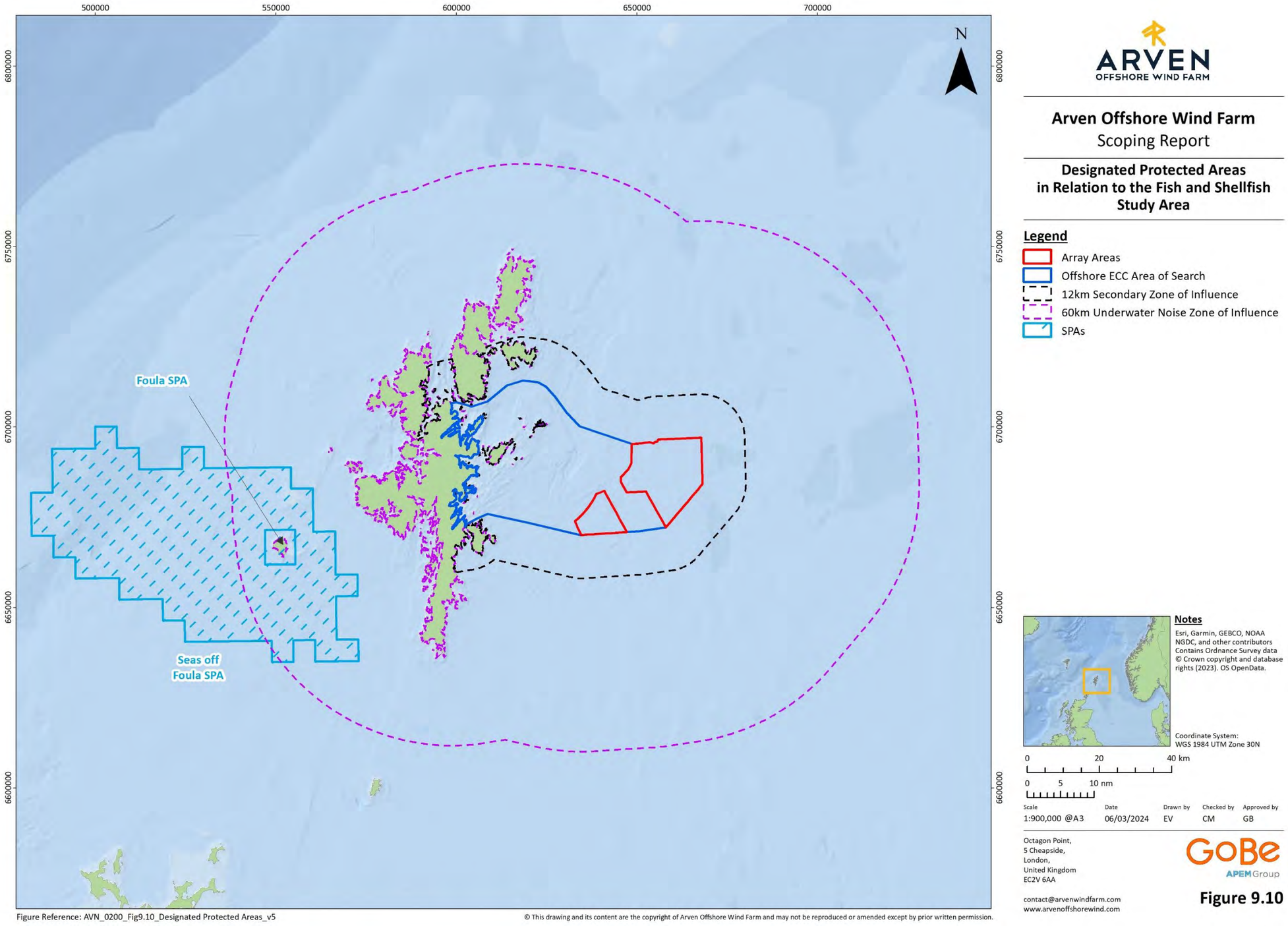
Scottish Priority Marine Species	
• Anglerfish; • Blue ling; • Ling; • Norway pout; • Lesser sandeel; • Whiting (juveniles); • Common skate;	• Mackerel; • Cod; • Herring; • Saithe (juveniles); • Raitt's sandeel; • Basking shark; and • Spurdog.
Wildlife and Countryside Act 1981	
• Basking Shark	
ICUN Red List	
• Atlantic salmon (Vulnerable); • Cod (Vulnerable); • European eel (Critically Endangered); • Basking shark (Endangered); • Blue shark (Near Threatened) • Spurdog (Vulnerable); • Tope (Vulnerable); • Sandy ray (Vulnerable); • Thornback ray (Near Threatened);	• Atlantic Halibut (Endangered); • Greenland Halibut (Near threatened); • Gulper Shark (Vulnerable); • Leafscale gulper shark (Vulnerable); • Porbeagle (Vulnerable); • Portuguese dogfish (Near Threatened); • Common skate (Critically Endangered); • Long-nosed skate (Near Threatened); and • While skate (Endangered).
Annex II Fish Species EU Habitats Directive (92/43/ECC)	
• Allis shad; • Atlantic salmon; • European eel;	• River lamprey; • Sea lamprey; and • Twaite shad.

9.5.5 Designated Sites

As part of this scoping exercise, a review has been undertaken to identify sites designated for nature conservation as well as protected species historically identified within the study area, that have relevance to fish and shellfish ecology. Within the fish and shellfish study area, as defined in Section 9.2, no sites designated for fish and shellfish features are present. There are two SPAs within the study area that have conservation objectives to maintain food/prey resources for the qualifying features (Table 9.4 and Figure 9.10). Identification of, and impacts to, these qualifying features are addressed in Chapter 11: Offshore Ornithology). In addition, there are a number of SPAs outwith the study area where qualifying interests may interact with the Offshore Proposed Development and that also have conservation objectives to maintain food/prey resources for the qualifying features (Chapter 11, Section 11.5.1). These include East Mainland Coast, Shetland SPA and Bluemull and Colgrave Sounds SPA (Chapter 11, Section 11.5.2).

Table 9.4: Sites designated for nature conservation within the study area, in relation to fish and shellfish ecology

Site	Conservation Objectives as relevant to fish and shellfish ecology
Seas off Foula SPA	The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained, or where appropriate restored, at Foula SPA and Seas off Foula SPA.
Foula SPA	As above



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Designated Protected Areas in Relation to the Fish and Shellfish Study Area

Legend
- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence
- SPAs

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Figure 9.10

Figure Reference: AVN_0200_Fig9.10_Designated Protected Areas_v5

Figure 9.10: Designated Protected Areas in Relation to the Fish and Shellfish Study Area

9.5.6 Migratory Species

Migratory fish are species that spend part of their life cycle in freshwater and part in seawater; such species are termed diadromous (migrate between freshwater and saltwater) and anadromous (migrating up rivers from the sea to spawn). Several migratory fish species have the potential to occur in the fish and shellfish ecology study area, migrating to and from rivers and other freshwater bodies in the area.

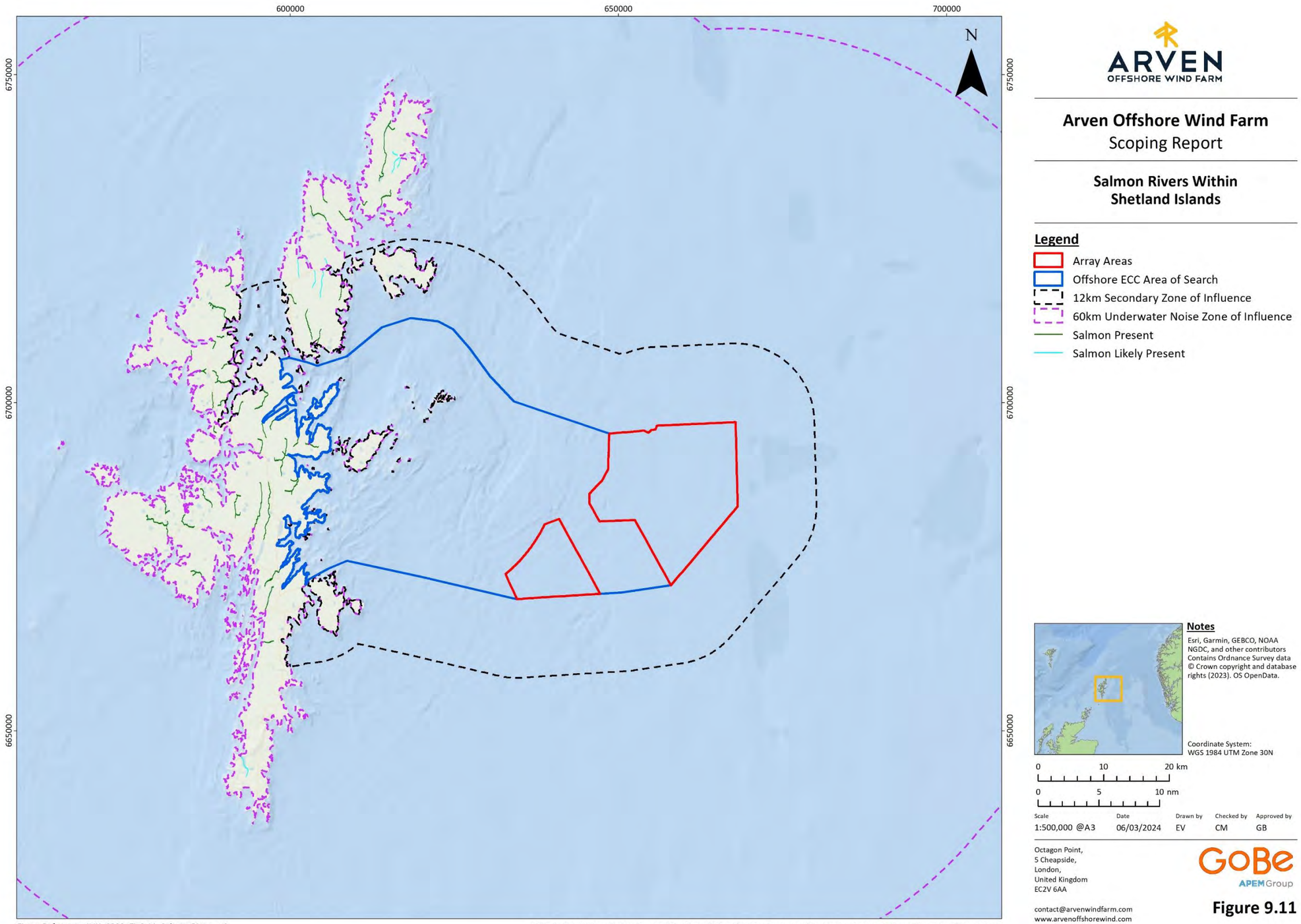
Migratory fish species have the potential to occur within the study area and surrounding areas, including Atlantic salmon (*Salmo salmar*). Several species of fish living in Scottish rivers migrate between the sea and the upper reaches of rivers during their life cycle. Atlantic salmon, sea trout (*Salmo trutta*) and lampreys (*Lampetra fluviatilis, Petromyzon marinus* and *Lampetra planeri),* spend most of their adult lives in the oceans but return to freshwater to reproduce. European eel (*Anguilla anguilla)* are also diadromous fish, whereby adult eels migrate out to sea to spawn, and their larvae make the return journey back to the freshwater environments of rivers (termed catadromous).

Salmon have been identified as being either present or likely to be present within rivers throughout the Shetland islands (Figure 9.11; Marine Scotland, 2023a). However, there is little data which details the specific migratory routes, if any, used by salmon from Scottish rivers to deeper ocean waters (Malcome *et al.,* 2010; Shearer, 1992). However, it has been theorised that salmon may use ocean currents to assist their migrations (McCurdy and Knox, 2004; Furey *et al*., 2015; Malcome *et al.,* 2010; Shearer, 1992). Studies on the migratory routes of salmon which exit rivers and enter the sea within and around the Moray Firth identified that the salmon predominantly moved in a northerly direction, which corresponds with the direction of the currents (Malcome *et al.,* 2010).

The rivers Thurso, Naver and Berriedale and Langwell Waters (approximately 250 km, 280 km, and 285 km from the Offshore Proposed Development, respectively), are the closest SACs with a qualifying interest in diadromous species (all Atlantic salmon). The marine migration routes of salmon leaving / entering these river systems is currently not fully understood.

9.5.7 Elasmobranchs

Elasmobranchs (sharks and rays) are a particularly sensitive species group due to their slow growth rates and fecundity (Marine Scotland, 2020). All sharks and rays living in Scottish Waters are included in the OSPAR list of threatened and/or declined species (Marine Scotland, 2020). There are low intensity nursery grounds for spurdog, common skate, and spotted ray throughout the study area (Ellis *et al.,* 2010; 2012, Coull *et al.,* 1998;Figure 9.6). Furthermore, there are records of sightings of basking shark (*Cetorhinus maximus)* across the Shetland and Orkney islands and within north and northeastern Scottish waters, between 2001 and 2015 (Marine Scotland, 2023b). Basking shark are considered an endangered species by the ICUN Red List and are included in the OSPAR list of threatened and/or declined species (NatureScot, 2020; Table 9.3).



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Salmon Rivers Within Shetland Islands

Legend
- Array Areas
- Offshore ECC Area of Search
- 12km Secondary Zone of Influence
- 60km Underwater Noise Zone of Influence
- Salmon Present
- Salmon Likely Present

Notes

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Coordinate System:
WGS 1984 UTM Zone 30N

0 10 20 km

0 5 10 nm

Scale	Date	Drawn by	Checked by	Approved by
1:500,000 @A3	06/03/2024	EV	CM	GB

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GoBe
APEM Group

Figure 9.11

Figure Reference: AVN_0200_Fig9.11_Salmon Rivers_v4

Figure 9.11: Salmon Rivers Within Shetland Islands

9.6 Embedded Mitigation

As part of the initial design process, embedded mitigation measures are proposed to reduce the potential environmental effects of development. Measures related to Fish and Shellfish Ecology are as follows:

- C-1: Development and adherence to a CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
- C-6: Development and adherence to an EMP. The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management.
- C-8: Appointment of an Environmental Clerk of Works (ECoW). The ECoW will monitor compliance of the Offshore Proposed Development with granted consents.
- C-9: Development of and adherence to a MPCP. The MPCP will identify potential sources of pollution and associated spill response and reporting procedures.
- C-11: Development of and adherence to a PS (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g. soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.
- C-12: Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction Project phases.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.
- C-15: Development of and adherence to a CoP. The CoP will confirm the timing and duration of the main Project construction activities.
- C-29: Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP.

9.7 Scoping of Impacts

Table 9.5 and Table 9.6 set out an initial assessment of the likelihood of effects on fish and shellfish ecology due to Offshore Proposed Development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the Project at the scoping stage; embedded mitigation (as set out in Section 9.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for fish and shellfish ecology effects due to Offshore Proposed Development activities; relevant policy; and the professional judgement of qualified fish and shellfish ecology specialists.

9.7.1 Potential Impacts Scoped In

Table 9.5 sets out the potential impacts that are proposed for scoping into the assessment for Fish and Shellfish Ecology.

Table 9.5: Impacts scoped into the assessment of Fish and Shellfish Ecology

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Construction and Decommissioning			
Increases in SSC and changes to seabed levels	Temporary elevations in SSCs have the potential to occur during construction (i.e., cable and foundation installation) activities and decommissioning activities. This could in turn lead to smothering of slow moving or sessile species and also localised changes in sediment type which may potentially impact seabed dependent species (e.g., sandeel and herring).	This assessment will be informed by the worst case parameters for cable and foundation installation activities during the construction phase, and decommissioning activities. Sediment plume modelling will be undertaken and used to inform the maximum plume extents and sediment deposition.	C-1 (CaP); C-6 (EMP); C-8 (ECoW); C-11 (PS); C-14 (DP); C-15 (CoP)
Temporary habitat disturbance	There is potential for temporary, direct habitat disturbance during construction activities in the Array Areas and along the OfECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. There is also potential during decommissioning. Temporary habitat disturbance has the potential to negatively impact species that are dependent on the seabed for some or all of their life cycle.	This assessment will be informed by the worst case parameters for seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring during the construction phase and decommissioning activities. Area of disturbance will be calculated and assessed in relation to the specific species recorded within the Array Area and along the OfECC (using existing and site-specific survey data) and their particular habitat requirements.	C-1 (CaP); C-8 (ECoW); C-11 (PS); C-14 (DP); C-15 (CoP)

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Direct and indirect disturbance leading to the release of sediment contaminants	Seabed disturbance during construction and decommissioning could lead to the mobilisation of existing sediment contaminants that could have an impact on fish and shellfish receptors. Effects on fish and shellfish ecology as a result of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments.	This assessment will be informed by the worst case parameters for sediment disturbance during the construction and decommissioning phases. The assessment will be informed by site specific surveys undertaken to review intertidal and subtidal sediment contamination across the site. These are detailed in Chapter 7: Marine Water & Sediment Quality.	C-1 (CaP); C-6 (EMP); C-8 (ECoW); C-9 (MPCP); C-14 (DP); C-15 (CoP)
Mortality, Injury, behavioral impacts, and auditory masking arising from noise and vibration	Potential effects from construction activities may arise from noise and vibrations from pile-driving for the installation of Offshore Substation Platform foundations (with the potential for anchor/mooring piling for floating foundations). Cable laying, dredging and vessel movements also have the potential to result in underwater noise. There is also potential for noise and vibration during decommissioning activities (e.g. foundation removal). Noise from piling has the potential to cause significant impacts to fish and shellfish species ranging from lethal trauma to behavioural changes in susceptible fish species. Underwater noise modelling will be undertaken as part of the EIA in line with worst case scenarios.	This assessment will be informed by the worst case parameters for noise and vibrations from pile-driving for the installation of Offshore Substation Platform foundations and any potential piling required for floating foundation anchors / mooring, cable laying, dredging and vessel movements during the construction phase and decommissioning activities. Underwater noise modelling will be undertaken to inform this assessment.	C-1 (CaP); C-8 (ECoW); C-11 (PS); C-12 (PEMP); C-14 (DP); C-15 (CoP)
Operation and Maintenance			

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Permanent and/or long-term habitat loss/alteration due to the addition of infrastructure to the area	Potential effects during the operational phase will mostly result from the physical presence of infrastructure (i.e., anchors, foundations, scour and cable protection above the seabed) which will result in long-term habitat loss. For floating foundations, abrasion from the mooring lines /anchor chains may also result in long-term habitat disturbance and will be considered. These effects have the potential for impacts on substrate dependent fish and shellfish, in particular those that have substrate specific spawning behaviours (e.g., sandeel, herring), or those with designated conservation status. Furthermore, the introduction of infrastructure has the potential to alter the fish and shellfish assemblage ecology within the area due to disturbance and/or removal of feeding grounds for these species and the subsequent changes in prey availability. Impacts on sensitive fish and shellfish species will be considered in terms of long-term loss of spawning habitats and impacts on species of conservation importance. The area of habitat loss will be defined using a worst-case scenario to determine the maximum loss of seabed, and the potential loss of herring and sandeel spawning grounds. It is considered that there are sufficient existing data to inform this assessment, and therefore no further surveys are proposed.	This assessment will be informed by the worst case parameters for the physical presence of infrastructure on the seabed. Area of habitat loss / potential alteration will be calculated in relation to the specific habitat biotopes recorded within the Array Area and along the OfECC (using existing mapping data and site-specific survey data) and assessed against specific species habitat requirements.	C-1 (CaP); C-8 (ECoW); C-12 (PEMP)

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
EMF effects arising from cables during operational phase	EMF may impact sensitive species, including elasmobranchs, teleost fish (i.e., flat fish, salmonids and gadoids) and crustaceans (e.g. brown crab (Scott *et al.,* 2018; Scott *et al.,* 2021, Tricas & Gill, 2011)) by altering foraging or migratory behaviour (Hutchison *et al.,* 2020). The magnitude of this impact will depend in part on the project design and the burial and cable protection measures which are utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column	This assessment will be informed by the worst case parameters for the presence of cables on the sea floor and the burial and cable protection measures utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column. It is acknowledged that there is limited, but emerging research on EMF impacts on fish and shellfish, especially for dynamic cables. The impact assessment will draw on the latest relevant available literature. No cable specific modelling is proposed.	C-1 (CaP); C-8 (ECoW); C-12 (PEMP); C-29 (Cable Burial)
Introduction of new hard substrates and potential for fish aggregation	Installed infrastructure may introduce new hard substrate for colonisation by encrusting marine organisms, including marine fauna that are not currently found in the existing environment. The EMP will include measures to reduce the spread of invasive species. Offshore infrastructure may act as a Fish Aggregation Device (FAD), providing refuge for some species and also habitat for some shellfish and benthic species, whilst also potentially attracting larger predators which could indirectly increase entanglement or collision risk for both fish and marine mammal species.	This assessment will be informed by the worst case parameters for the installed infrastructure during the operation and maintenance phase and assessed in terms of the amount of hard substrate that will become available in relation to specific species habitat requirements.	C-6 (EMP)

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Increased risk of introduction or spread of INNS	Increased risk of introduction or spread of Marine INNS due to the presence of the subsea infrastructures and increased vessel movements may facilitate the spread of non-native species and may subsequently impact biodiversity and assemblages of Fish and Shellfish ecology of the area.	This assessment will be informed by the worst case parameters for the installed infrastructure during the operation and maintenance phase. The potential introduction or spread of Marine INNS and subsequent impact to local Fish and Shellfish ecology receptors will be assessed based on current industry understanding, available literature and expert knowledge. The assessment will take into consideration the mitigation and control of invasive species measures that will be incorporated into the EMP. Consideration of the mitigation and control of invasive species measures in line with IMO will be given (IMO, 2019). These standards and procedures will be incorporated into the EMP and are embedded in the project design and as such ensure that no significant effects arise from INNS.	C-6 (EMP); C-8 (ECoW); C-12 (PEMP)
Ghost fishing due to lost fishing gear	There is the potential for lost gear to become entangled within mooring lines and suspended cables associated with	This assessment will be informed by the worst case parameters relating to the	C-1 (CaP); C-8 (ECoW); C-12

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
becoming entangled in installed infrastructure	floating substructures, if this technology is utilised, leading to ghost fishing which may negatively impact fish and shellfish.	presence of mooring lines and suspended cables. Where appropriate, the impact assessment will draw on the latest relevant available literature on this impact.	(PEMP); C-29 (Cable Burial)

9.7.2 Potential Impacts Scoped Out

Table 9.6 sets out the potential impacts that are proposed for scoping out of the assessment for Fish and Shellfish Ecology.

Table 9.6: Impacts proposed to be scoped out of further assessment for Fish and Shellfish Ecology

Impact	Justification
Construction and Decommissioning	
Direct damage (e.g. crushing) and disturbance to mobile demersal and pelagic fish and shellfish species	There is potential for direct damage to occur during construction activities in the Array Areas and along the OfECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. There is also the potential for direct damage to occur as a result of decommissioning activities. Affected species are however likely to be mobile and can move away from disturbance, furthermore, crushing impacts on stationary receptors will be on a small spatial scale, and will not result in significant population level effects.
Accidental pollution event during construction or decommissioning activity	Accidental releases of pollutants may arise as a result of accidental spills from vessels or other equipment and have detrimental effects on fish and shellfish. However, the risk and impact of accidental releases of hazardous substances will be reduced through the implementation of the EMP and MPCP. In this manner, accidental release of potential contaminants from construction vessels will be strictly controlled and procedures will be in place to minimise the impact of any accidental release if it occurs, and hence the impact has been scoped out of the EIA.
Operation and maintenance	
Direct disturbance resulting from maintenance during operational phase	There is the potential for direct habitat disturbance of the seabed during planned and unplanned maintenance activities (e.g., the use of jack up vessels or cable repair or replacement). However, affected fish and shellfish species are likely to be mobile and can move away from disturbance.
Accidental pollution during operational phase	See justification described for accidental pollution events during construction and decommissioning activity above.

Impact	Justification
Underwater noise	Underwater noise as a result of operational turbines, has a relatively low frequency and pressure level (Andersson *et al.,* 2011). A desk-based literature review of existing data and past studies of underwater noise associated with operational OWFs and their maintenance supports the understanding that there will be no likely significant effects on fish and shellfish communities as a result of operation and maintenance activities. It is important to note, underwater noise generated from maintenance vessel traffic is likely to be low and would only have an impact on fish species if they remained in close proximity to the vessel for several hours.

9.8 Potential Cumulative Impacts

Chapter 4: EIA Methodology details how potential cumulative impacts will be assessed through a CIA. For fish and shellfish ecology, cumulative interactions may occur with other planned OWF as well as other activities in the study area.

Impacts that are scoped into the assessment for the Offshore Proposed Development alone, are generally spatially restricted to being within close proximity to the Array Areas and OfECC. However, certain potential impacts, such as an increase in SSC and underwater noise have the potential to affect the fish and shellfish communities over a more significant area. It is proposed that impacts with limited spatial extent, that do not have an effect on a present species, site, or feature, are scoped out of any further assessment within the EIA.

For this reason, the following impacts on fish and shellfish ecology receptors are being proposed for further consideration within the CIA:

- Temporary increase in suspended sediment and sediment deposition arising from construction and decommissioning activities; and
- Mortality, injury and behavioural changes resulting from underwater noise arising from construction and decommissioning activities.

9.9 Potential Transboundary Impacts

Transboundary impacts related to fish and shellfish ecology are not anticipated to arise from construction, O&M or decommissioning stages of the Offshore Proposed Development. Any impacts on fish and shellfish receptors will be localised in nature (including those giving rise to the greatest footprint of effect such as underwater noise from piling), and any indirect effects will likely be limited to one tidal excursion from the impact source. The Offshore Proposed Development is a significant distance (approximately 110 km) from the nearest adjacent EEZ of another state (Norway) and therefore it is considered that transboundary impacts will not occur. As such these are scoped out for further consideration within the EIAR.

9.10 Proposed Approach to EIA

This section outlines the proposed EIA approach to Fish and Shellfish Ecology for the Offshore Proposed Development. This includes the proposed assessment methodology, relevant embedded mitigation measures as well as those measures scoped into and out of the assessment.

9.10.1 Relevant Guidance

In addition to the general approach and guidance outlined in Chapter 4: EIA Methodology, the assessment of fish and shellfish ecology receptors will also comply with the following guidance documents where they are specific to this topic:

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine from the Chartered Institute for Ecology and Environmental Management (CIEEM, 2018);
- Guidance note for EIA in respect of the Food and Environment Protection Act, 1985 (FEPA and CPA, 1949 requirements (Cefas *et al*., 2004);
- Strategic Review of OWF Monitoring Data Associated with FEPA Licence Conditions (Walker *et al*., 2009);
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy projects (Judd, 2012);
- Guidance on Environmental Considerations for OWF Development (OSPAR, 2008).
- Sensitivity of features based upon the Marine Evidence Based Sensitivity Assessment (MarESA) framework where possible (MarLIN, 2022);
- Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report (Popper *et al*., 2014);
- Information gaps in understanding the effects of noise on fishes and invertebrates (Hawkins *et al*., 2014);
- A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates (Hawkins and Popper, 2016);
- Monitoring Guidance for Underwater Noise in European Seas, Part II Monitoring Guidance Specifications (Dekeling *et al*., 2014);
- Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards - Phase I (Natural England, 2021a); and
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards - Phase III (Natural England, 2021b).

9.10.2 Anticipated Additional Data Sources at EIA

A thorough desk-based collation and review of the relevant data will be undertaken to inform the subsequent EIA including the data sources listed within Table 9.2 as well as site specific surveys.

The characterisation of the fish and shellfish species found within the vicinity of the Offshore Proposed Development will be completed by drawing upon work that has been undertaken in support of various OWF projects in the region, as well as wider information from publicly available sources. Additional data sources will include;

- Detailed review of 'Developing Essential Fish Habitat Maps for Fish and Shellfish Species in Scotland' (Franco et. al., 2022);

- Available data from the Shetland Flapper Skate Tagging Project, a two year tagging project around the Shetland seas (https://www.shetland.uhi.ac.uk/research/fisheries/shetland-flapper-skate-tagging-project);
- Understanding the Potential for Marine Megafauna Entanglement Risk from Marine Renewable Energy Developments (2014), a NatureScot commissioned report (No. 791);
- Publications and reports by the Predators and Prey Around Renewable Energy Developments (PrePARED) Project;
- Any new research or publications concerning the effects of EMF; and
- Site specific benthic survey data and reporting, inclusive of eDNA analysis of gathered water samples for a variety of assays.

The use of publicly available datasets for fish and shellfish ecology combined with site-specific benthic survey data is considered sufficient to establish a robust baseline for an OWF at this specific location, which will form the basis for the EIA for the Offshore Proposed Development. The results of the benthic ecology surveys (including drop down videos and sediment grabs) will be used to understand the suitability of the seabed habitat at the Offshore Proposed Development for fish and shellfish species and particularly in relation to potential sandeel, cod and herring spawning suitability.

9.10.3 Assessment Methodology

To enable the potential impacts of the Offshore Proposed Development to be assessed, a description of the existing fish and shellfish populations, focusing particularly on any areas of conservation interest, will be undertaken. Potential impacts that may occur on fish and shellfish ecology as a result of the planned construction, O&M and decommissioning will then be identified. The sensitivities of the populations present to the types of impact expected from wind farm construction, O&M and decommissioning will be assessed. Where necessary, measures will be proposed to mitigate the impacts.

There is no intention to undertake site-specific trawl surveys in relation to fish and shellfish ecology for the Offshore Proposed Development.

The benthic ecology survey campaign includes DDV, grab samples, contaminant and PSA analysis. The benthic ecology survey, geophysical data and predictive habitat maps will be used to determine seabed suitability for fish and shellfish species and in particular sandeel, cod and herring spawning suitability due to their specific seabed needs, as well as link to consideration of changes to prey availability. The benthic ecology survey campaign also includes the collection of eDNA samples which will be laboratory analysed in order to further inform the EIA. The current requirements and expectations for eDNA sampling and analysis are not yet confirmed through published guidance, however consultation is taking place with statutory authorities to agree any specific requirements and associated methodology that should be adopted for eDNA analysis.

Underwater noise modelling using INSPIRE software will be undertaken during the EIA to assess the potential for mortality, permanent and temporary injury and behavioural disturbance of noise sensitive fish and shellfish receptors based on impact thresholds reported in Popper *et al.,* (2014). This will be carried out on fish and shellfish as both stationary and fleeing receptors. The worst-case underwater noise modelling locations in the Array Areas will be selected to calculate the maximum potential impacts to noise sensitive fish and shellfish receptors resulting from piling, UXO clearance and other construction activities such as vessel noise, dredging

and trenching. The methods will be fully detailed in the underwater noise technical report submitted as an appendix to the Marine Mammal and Fish Ecology chapters as part of the EIA.

In the event that the Offshore Proposed Development has a direct impact on any sites that are designated for conservation at the European (SAC, now forming part of the UK's National Site Network) or international level (Ramsar), as a result of qualifying habitats or species that they support, then the requisite information will be provided alongside the EIAR to assist the CA to carry out an AA. This information has been presented within a separate Offshore HRA Screening Report, which identifies the need for any further AA requirements or for a separate RIAA.

Cumulative impacts will be assessed by taking into consideration any other developments, proposed or existing, that are in the vicinity of the Offshore Proposed Development or that potentially have connectivity to fish and shellfish receptors, as discussed in Section 9.7.

9.11 Scoping Questions

The following scoping questions refer to the fish and shellfish ecology chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those data listed in Section 9.3, and any additional anticipated data listed in Section 9.10.2, being used to inform the Offshore EIA?
- Do you agree that publicly available datasets for fish and shellfish ecology combined with site-specific benthic survey data (inclusive of eDNA analysis) is considered sufficient to establish a robust baseline?
- Do you agree with the proposed study areas identified for the fish and shellfish receptors?
- Do you agree that all receptors related to Fish and Shellfish Ecology have been identified?
- Do you agree with the suitability of the embedded mitigation measures we have considered and proposed for inclusion?
- Do you agree with the scoping in and out of impacts related to Fish and Shellfish Ecology?
- Do you agree to the scoping out of the assessment of transboundary effects in relation to Fish and Shellfish Ecology?
- Do you agree with the scoping in and out of cumulative effects related to Fish and Shellfish Ecology?
- Do you agree with the proposed assessment methodology related to Fish and Shellfish Ecology?

10 Marine Mammals

10.1 Introduction

This chapter of the Offshore Scoping Report identifies the marine mammal receptors of relevance to the Offshore Proposed Development. The potential impacts from construction, O&M, and decommissioning of the Offshore Proposed Development on marine mammal receptors are identified. The proposed scope of the EIA, assessment methods and Embedded Mitigation Measures are also presented.

Based on the eight months of site-specific DAS surveys (April – November 2023) reported to date, harbour porpoise (*Phocoena phocoena*), white-beaked dolphin (*Lagenorhynchus albirostris*), minke whale (*Balaenoptera acutorostrata*) and grey seal (*Halichoerus grypus*) have been recorded. From the literature review the other key marine mammal species considered, in addition to harbour porpoise, white-beaked dolphin, minke whale and grey seal, are Risso's dolphin (*Grampus griseus*), white-sided dolphin (*Lagenorhynchus acutus*), killer whale (*Orcinus orca*), humpback whale (*Megaptera novaeangliae*) and harbour seal (*Phoca vitulina*). Other marine mammals which may occasionally be present within Shetland waters include short-beaked common dolphin (*Delphinus delphis*), long-finned pilot whale (*Globicephala melas*), bottlenose dolphin (*Tursiops truncatus*), fin whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), striped dolphin (*Stenella coeruleoalba*) and beaked whale species (*Mesoplodon spp*) (Hague *et al*., 2020).

This chapter should be read alongside the following chapters:

- Chapter 6: Marine Geology, Oceanography and Physical Process;
- Chapter 7: Marine Water & Sediment Quality;
- Chapter 8: Benthic Subtidal and Intertidal Ecology; and
- Chapter 9: Fish and Shellfish Ecology.

This chapter of the Offshore Scoping Report for the Offshore Proposed Development has been prepared by GoBe Consultants.

10.2 Study Area

The study area for marine mammals is based on two spatial scales: the site-specific marine mammal study area and the regional marine mammal study area.

The site-specific marine mammal study area is defined by the Offshore Proposed Development site-specific DAS area and is the same for all species. The DAS are being carried out monthly by HiDef to inform the baseline understanding within the site-specific study area; these started in April 2023, and are scheduled to March 2025, inclusive. The site-specific study area is comprised of 2.5 km spaced transects in the Offshore Proposed Development Array Areas plus a 6 km buffer. The data gathered by DAS will provide an indication of the local densities of marine mammal species (Figure 10.1).

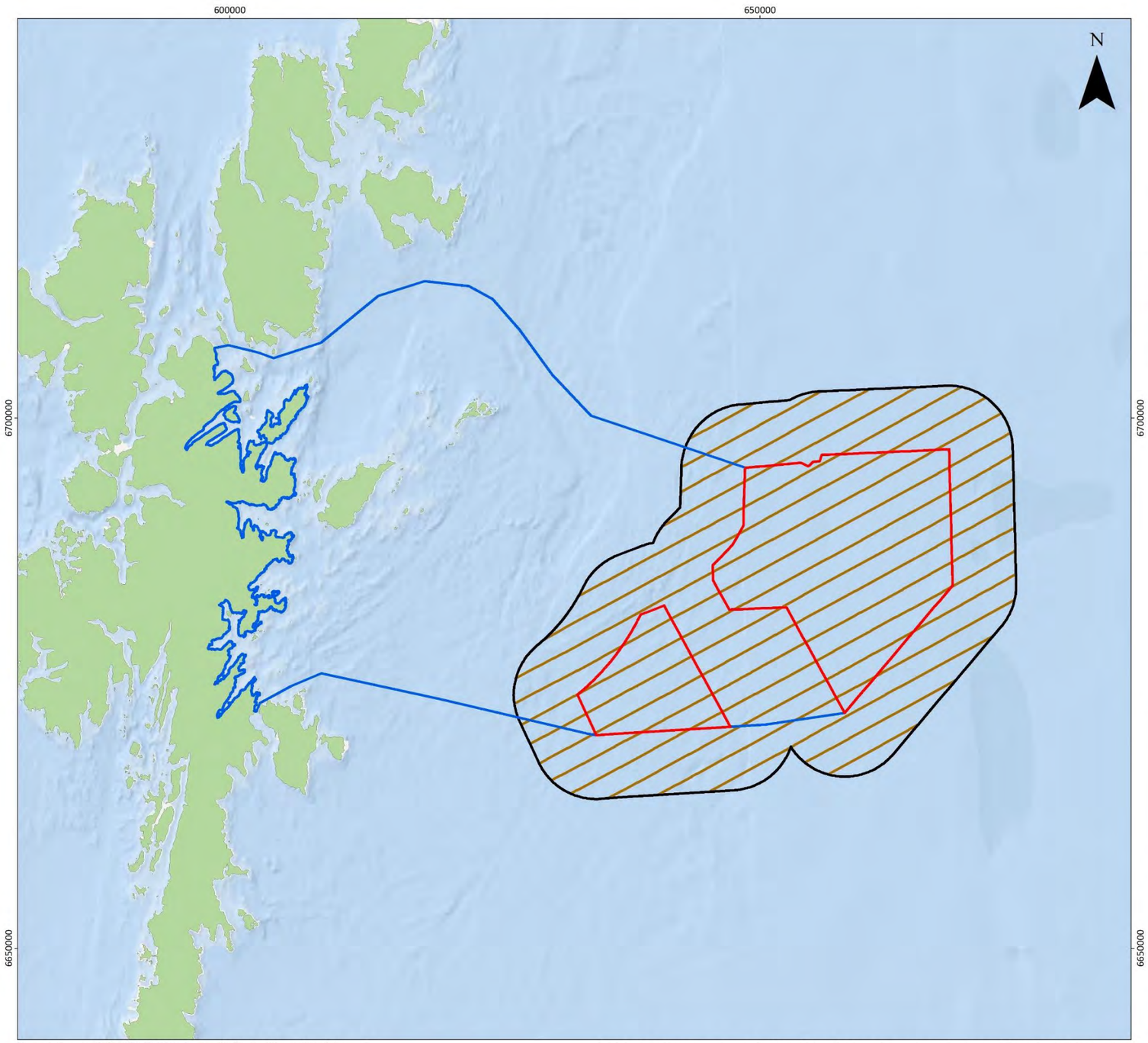
The regional marine mammal study area encompasses a wider geographic area and is defined by the species Management Units (MU) (Figure 10.2). An MU typically refers to a geographical area in which the animals of

a particular species are found, to which management of human activities is applied. It may be smaller than what is believed to be a 'population' (which is defined as a collection of individuals of the same species found in the same area, where genetic variation occurs within the population and between other populations), to reflect spatial differences in human activities and their management (IAMMWG, 2023). Using MUs in the assessment of cetacean species allows consideration of the scale of movement of a species and its respective populations, whilst taking account of jurisdictional boundaries and the management of human activities.

MUs are based on the structure of marine mammal populations, as a result the regional study area differs per species. These will be used to define the reference population in the quantitative impact assessment to be undertaken in the EIA. The marine mammal regional study areas are provided in Table 10.1.

Table 10.1: The marine mammal regional study areas and the relevant species

Marine Mammal Regional Study Area	**Relevant Species**
North Sea (NS) MU	Harbour porpoise
Celtic and Greater North Sea (CGNS) MU	Minke whale
	White beaked dolphin
	White sided dolphin
	Risso's dolphin
Seal Management Unit (SMU) 5: Shetland	Grey seal
	Harbour seal



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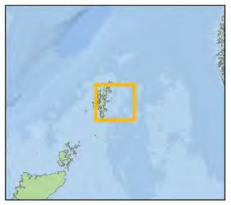
Site Specific Marine Mammal Study Area

Legend
- Array Areas
- Offshore ECC Area of Search
- 6km Buffer
- Digital Aerial Survey Transects



Notes
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Coordinate System:
WGS 1984 UTM Zone 30N

0 10 20 km
0 2 4 6 nm

Scale	Date	Drawn by	Checked by	Approved by
1:350,000 @A3	06/03/2024	EV	CM	GB

Octagon Point,
5 Cheapside,
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www.arvenoffshorewind.com

GoBe
APEM Group

Figure 10.1

Figure Reference: AVN_0200_Fig10.1_Site Specific Marine Mammal Study Area_v3

Figure 10.1: Marine Mammal Study Area

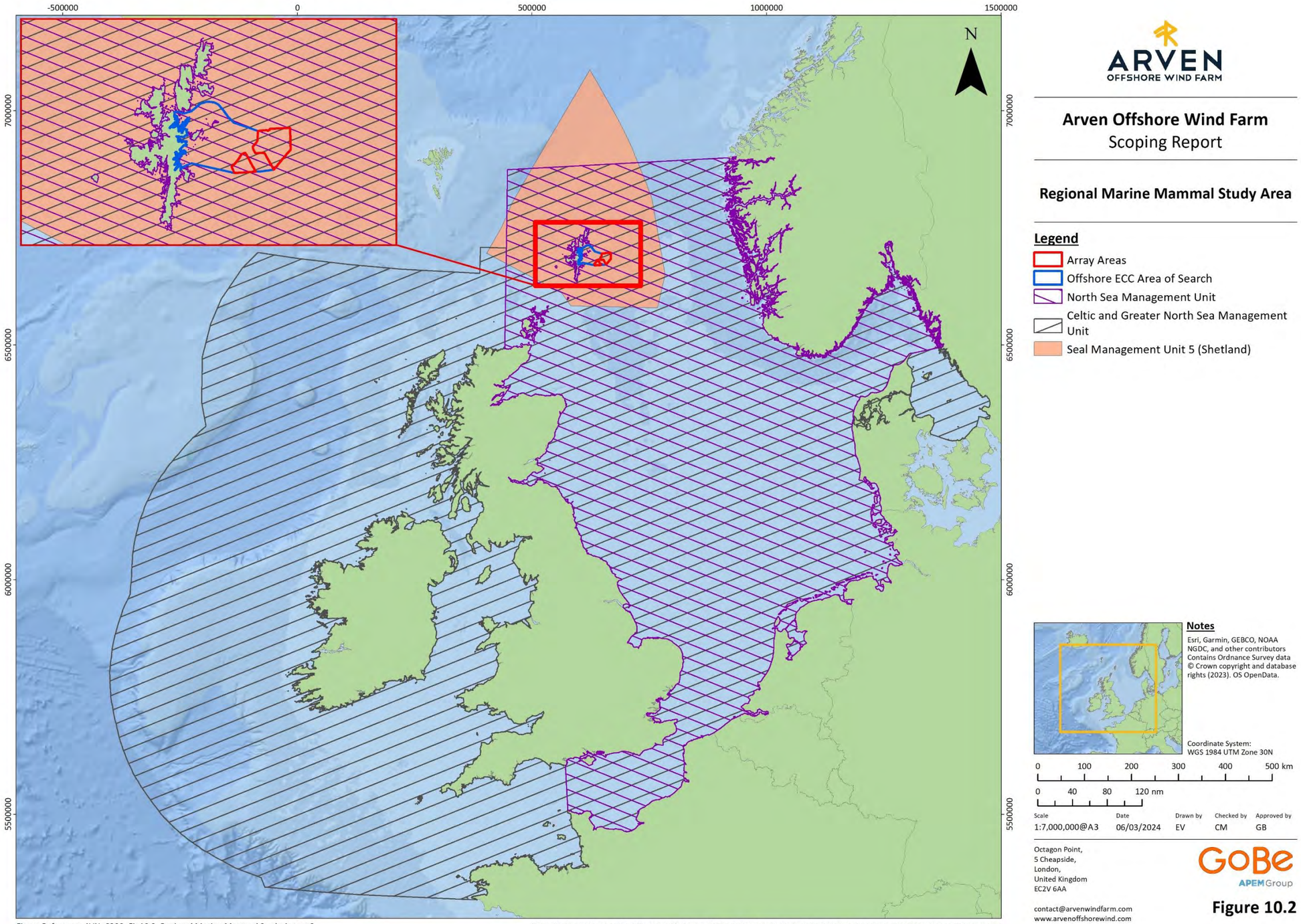


Figure Reference: AVN_0200_Fig10.2_Regional Marine Mammal Study Area_v3

Figure 10.2: Regional Marine Mammal Study Area

10.3 Data Sources at Scoping

An initial desk-based literature review has identified key existing data sets and literature that have been used to inform the Offshore Scoping Report, which are presented in Table 10.2. This is not an exhaustive list of sources but is considered to include the most relevant. When new, relevant data and/or reports are published, these may be incorporated into the EIA.

Table 10.2: Data sources used to inform the Marine Mammals scoping chapter

Title	Summary	Source	Author and year
Site-specific DAS for the Array Areas and the 6 km buffer	Site-specific baseline digital aerial surveys (24 surveys between April 2023 and March 2025). Only a certain proportion of the data (April 2023 – November 2023) was available to inform this Offshore Scoping Report. Survey methodology agreed with NS.	The Developer	HiDef, 2023a, HiDef 2023b, HiDef 2023c
Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys (September 2023)	Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Aerial and boat-based surveys were conducted in 2022 to provide large-scale estimates of small cetacean abundance in European Atlantic waters.	https://www.tiho-hannover.de/en/clinics-institutes/institutes/institute-of-terrestrial-and-aquatic-wildlife-research-itaw/scans-iv-survey	Gilles *et al.* 2023
Review of Management Unit boundaries for cetaceans in UK waters (2023)	This report details abundance estimates for seven of the most common cetacean species in UK waters within their respective MUs.	https://data.jncc.gov.uk/data/b48b8332-349f-4358-b080-b4506384f4f7/jncc-report-734.pdf	IAMMWG, 2023
Scientific Advice on Matters Related to the Management of	The Special Committee on Seals (SCOS) provides scientific advice to the government on matters relating to the management of UK seal populations. There have been	http://www.smru.st-andrews.ac.uk/files/2023/09/SCOS-2022.pdf	SCOS, 2023

Title	Summary	Source	Author and year
Seal Populations: 2022	numerous reports collated that identify any conservation and management issues, including ecology, behaviour, population trends and estimates, important areas and the status of both grey and harbour seals in the UK.		
Whale and Dolphin Sightings	Sightings records made by ORCA's citizen scientists over ca. 30 years. The data gives insights into cetacean hotspots and regional species diversity, although it is not effort-based[5] data.	https://orca.org.uk/whale-dolphin-sightings	ORCA, 2023
Sea Watch Foundation sightings	Sightings records made by Sea Watch Foundation citizen scientists. The map gives insights into cetacean hotspots and regional species diversity, although it is not effort-based data.	https://www.seawatchfoundation.org.uk/recentsightings/	Sea Watch Foundation, 2023
Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys	The report describes the density surface modelling for those cetacean species for which sufficient data were obtained during SCANS-III surveys across the North-East Atlantic.	https://scans3.wp.st-andrews.ac.uk/files/2022/08/SCANS-III_density_surface_modelling_report_final_20220815.pdf	Lacey *et al.* 2022
POISEIDON DAS Surveys	A collection of strategic environmental baseline data, updated spatial models for key	https://naturalengland.blog.gov.uk/2023/02/01/pose	Natural England

[5] effort-based data are collected on a dedicated survey, recording information on duration of survey and sightings. Opportunistic data are sightings only, where there is no information on effort (i.e. duration of survey)

Title	Summary	Source	Author and year
	species and the habitats most vulnerable to offshore wind impact and mapping of the environmental risk	idon-offshore-wind-and-nature/	
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys	Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Aerial and boat-based surveys were conducted in 2016 to provide large-scale estimates of small cetacean abundance in European Atlantic waters.	https://scans3.wp.st-andrews.ac.uk/files/2021/06/SCANS-III_design-based_estimates_final_report_revised_June_2021.pdf	Hammond *et al.* 2021
Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management	These reports provide estimates of at-sea distribution for both grey and harbour seals from haul-outs in the British Isles. The predictions are based on regional models of habitat preference.	https://www.frontiersin.org/articles/10.3389/fmars.2022.875869/full	Carter *et al.* 2022
Scottish Killer Whale Photo ID Catalogue 2021	ID catalogue which identifies all the known individual killer whales that frequent Scottish waters as of January 2021	https://www.researchgate.net/profile/Andrew-Scullion-5/publication/354418921_Scottish_Killer_Whale_Photo_Identification_Catalogue_2021/links/613776a72b40ec7d8bf0c522/Scottish-Killer-Whale-Photo-Identification-Catalogue-2021.pdf	Scullion *et al.* 2021
Shetland Tidal Array Monitoring	This report presents the results from analyses of Nova Innovation's nine-year programme of land-based marine wildlife observation surveys	https://marine.gov.scot/sites/default/files/enfait-	Smith *et al.* 2021

Title	Summary	Source	Author and year
Report: Vantage point surveys	in Bluemull Sound, carried out as part of the environmental monitoring programme for the Shetland Tidal Array. Marine mammal sightings were recorded during vantage point surveys which were carried out over a nine-year period.	0347_sta_vp_report_final.pdf	
Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters	This report collates and provides information on the abundance and distribution of marine mammal species in the Scottish Northern North Sea region and Scottish Atlantic waters, with a focus on what were the draft plan option (DPO) sites identified in the Draft Sectoral Marine Plan for Offshore Wind Energy for Scotland.	https://data.marine.gov.scot/sites/default/files/Scottish%20Marine%20and%20Freshwater%20Science%20%28SMFS%29%20Vol%2011%20No%2012%20Regional%20baselines%20for%20marine%20mammal%20knowledge%20across%20the%20North%20Sea%20and%20Atlantic%20areas%20of%20Scottish%20waters.pdf	Hague *et al.* 2020
Distribution maps of cetacean and seabird populations in the northeast Atlantic	Collation and standardization of survey data for cetaceans and seabirds, with distribution maps in the northeast Atlantic. Survey data (aerial and vessel) from 1980-2018. Distribution maps for 12 cetacean species at 10km resolution.	https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.13525	Waggit *et al.* 2020
North Atlantic Killer Whales (*Orcinus orca*) Migrating between Iceland and Scotland. A short identification catalogue	ID catalogue of individual killer whales that migrate between Iceland and Scotland. Images were taken from Scottish mainland, Orkney Islands, Shetland Islands, and the Hebrides and compared with images taken in West Iceland	https://orcaguardians.org/wp-content/uploads/2019/05/Killer-Whales-Migrating-between-Iceland-and-Scotland.pdf	Mrusczok and Scullion, 2019

Title	Summary	Source	Author and year
	along the Snædellsnes Peninsula 2014-2018.		
Revised Phase III data analysis of joint cetacean protocol data resources	This report collates and provides information on the abundance and distribution of cetacean species in the UK.	https://data.jncc.gov.uk/data/01adfabd-e75f-48ba-9643-2d594983201e/JNCC-Report-517-FINAL-WEB.pdf	Paxton *et al.* 2016
Atlas of cetacean distribution in northwest European waters	This Atlas provides an account of the distribution of all 28 cetacean species that are known to have occurred in the waters off northwest Europe, at the time of publication.	https://data.jncc.gov.uk/data/a5a51895-50a1-4cd8-8f9d-8e2512345adf/atlas-cetacean-distribution-web.pdf	Reid *et al.* 2003
UHI sightings data	Shore based sightings data, data layers, density maps and density records.	N/A	University of Highlands and Islands Shetland, n.d.
Whale and Dolphin Conservation surveys	Three years of effort weighted surveys around Shetland	N/A	Whale and Dolphin Conservation, n.d.
Shetland Biological Records Centre	Marine mammal density mapping	N/A	Shetland Biological Records Centre, n.d.

10.4 Pre-Scoping Engagement

During the pre-scoping workshop in November 2023 UHI Shetland, the MD-SEDD, and NatureScot highlighted additional baseline data sources:

- SIRMP State of the Environment Assessment (Shucksmith, 2017), which includes shore-based sightings data, data layers, density maps and density records;
- Whale and Dolphin Conservation shorewatch survey data for the Shetland group, 3 years of effort weighted data available;
- Whale and Dolphin Conservation Risso dolphin photo-ID catalogue;

- University of Highland and Islands Shetland spatial data from the Shetland Biological Records center including density maps;
- Harbour porpoise distribution study using F-POD and drone surveys;
- MD-SEDD PAM data from the Scottish Passive Acoustic Network (SPAN);
- Ferry sightings data;
- NS queried the classification of basking shark within the 'migratory species' group and whether better considered under marine mammals or fish and shellfish ecology (now included under fish and shellfish ecology, given classification of basking shark as elasmobranch species for underwater noise modelling purposes);
- Ecological Consequences of Orca Predation on Seals (ECOPredS) project outputs; and
- Sea Mammal Research Unit (SMRU) seal telemetry tagging project.

The Developer will look to access and review the suggested data sources to inform the EIA.

During the workshop the following points were raised:

- Consideration of species scoped into EIA, including Killer whale;
- Use of SCANS-IV data (Gilles *et al*. 2023) to inform baseline for cetaceans where possible;
- Use of Carter *et al*. (2022) to inform baseline for harbour and grey seals;
- Consider scoping in EMF impacts on prey and collision risk with floating turbines; and
- Potential use of Passive Acoustic Monitoring (PAM) monitoring to supplement DAS.

10.5 Baseline Environment

The following section presents the baseline environment for marine mammals including cetaceans (whales, dolphins, and porpoise) and pinnipeds (seals) most likely to be present within the Array Areas and OfECC area of search, and proximate to potential Landfall sites. Baseline information is derived from analysis of survey data, historical records, and a review of literature relevant to the region (Table 10.2). This exercise has informed which marine mammal species have been scoped into the assessment.

The marine mammal species scoped in are those that are most likely to be present within the site-specific marine mammal study area, these are: harbour porpoise, white-beaked dolphin, Risso's dolphin, Atlantic white-sided dolphin, minke whale, killer whales, humpback whale, harbour seal and grey seal. Further information on the occurrence of these species is detailed in Sections 10.5.1.1.1 to 10.5.1.2.2.

Other species are occasionally sighted in the region including common dolphin, long-finned pilot whale, fin whale, sperm whale, striped whale, and beaked whale species, but given they are infrequently recorded in this region and do not have a density estimate in SCANS IV (Gilles *et al.* 2023), they have been scoped out at this stage.

Whilst bottlenose dolphins are present on the east coast of Scotland and in the Moray Firth, they are rarely sighted off Shetland. There were no sightings in SCANS-IV Block NS-E (Gilles *et al.* 2023), Orca whale and dolphin sightings (Orca, 2023) or Sea Watch Foundation (2023) sightings. Whilst there are some historical recordings for bottlenose dolphins around Shetland from collated data sources presented in Hague *et al.* (2020), it was agreed in the Marine Mammal Scoping Workshop on 28 November 2023 that bottlenose dolphin can be scoped out of further assessment. A review of the DAS data will take place for the marine mammal baseline localisation to inform whether the species will remain scoped out of the EIAR.

10.5.1 Offshore Array Areas and Offshore Export Cable Corridor

10.5.1.1 Cetaceans

10.5.1.1.1 Harbour porpoise

Harbour porpoise are the most abundant cetacean species in the British Isles and within Shetland waters, where they occur year-round. The Array Areas and OfECC overlap with SCANS-IV Block NS-E which has an estimated harbour porpoise density of 0.5156 (CV=0.208) animals/km² and an abundance of 33,735 (95% CI=21,757-50,324) (Gilles *et al*. 2023). This is an increase from the Block T[6] density and abundance estimate from the 2016 SCANS III survey of 0.402 (CV=0.295) animals/km² and 26,309 individuals (95% CI = 14,219-45,280) (Hammond *et al*. 2021). Using the SCANS III data Lacey *et al*. (2022) predicted a harbour porpoise surface density of 0.25-0.5 animals/km² in Shetland waters and the surrounding area. The Array Areas and OfECC overlaps with the North Sea MU for harbour porpoise which has an estimated abundance of 159,632 (95% CI=127,442-199,954; CV=0.12) animals in the UK portion of the MU (IAMMWG, 2023). Harbour porpoises were sighted in seven of the eight months of site-specific DAS analysed to date (April – November 2023) with a total of 46 individuals recorded over that period (HiDef 2023a, HiDef 2023b, HiDef 2023c) (Figure 10.3). Land based marine wildlife surveys carried out for the Shetland tidal array in Bluemull Sound, Shetland, over the nine-year programme, reported that harbour porpoise were the most frequently recorded cetacean species, accounting for 45% of all marine mammal sightings, and there was no systematic seasonal or diurnal variance in their occurrence (Smith *et al.* 2021). The overall trend in conservation status of harbour porpoise within UK waters is unknown due to insufficient data to establish a population trend (JNCC, 2019a).

[6] Block T in SCANS III survey is the equivalent to Block NS-E in the SCANS IV survey, overlapping with Shetland and the Array Areas and OfECC

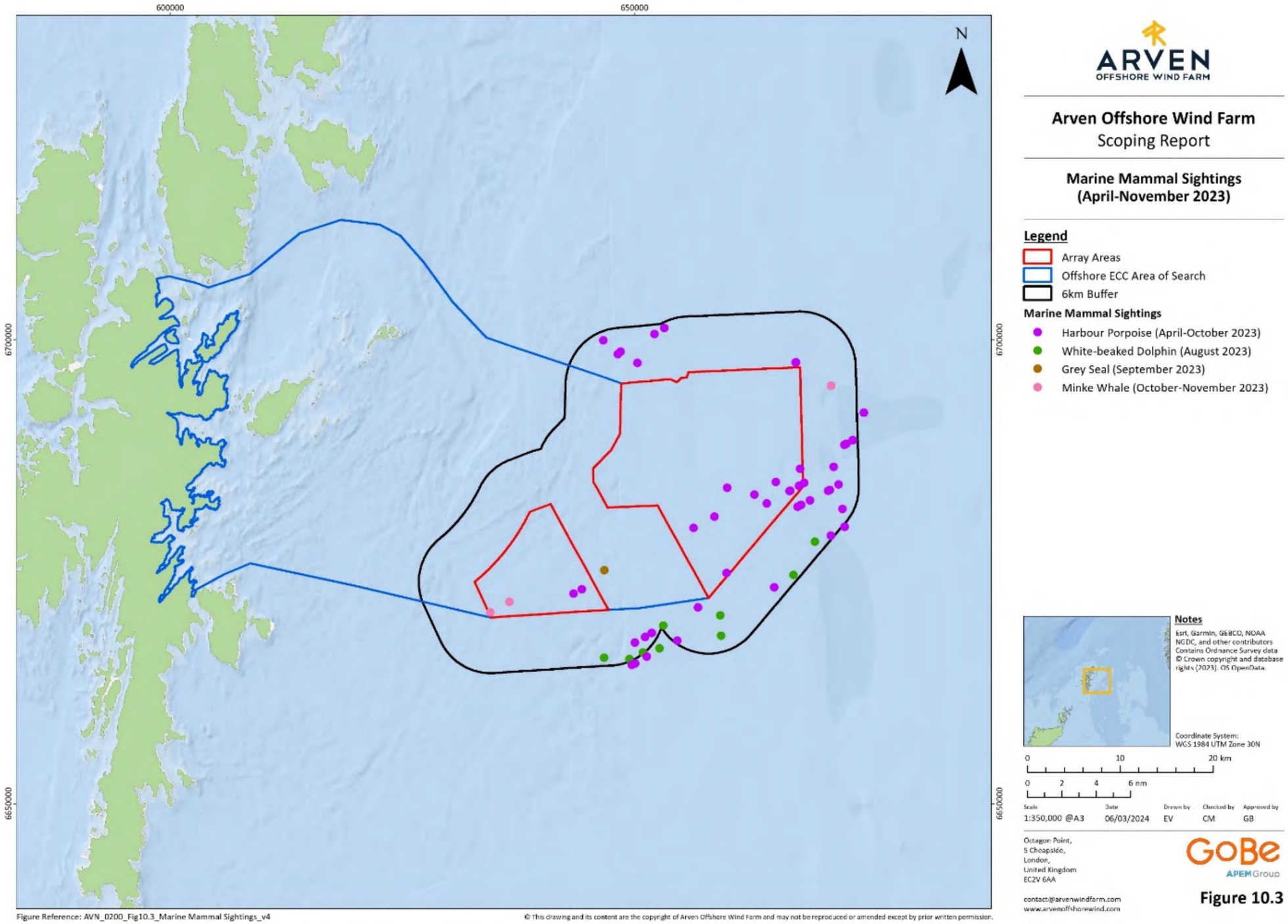


Figure 10.3: Marine Mammal Sightings (April-November 2023)

10.5.1.1.2 White-beaked dolphin

White-beaked dolphins are present across the North Sea where they occur year-round, with increased sightings during the summer months (Hague *et al*. 2020). SCANS-IV Block NS-E has an estimated white-beaked dolphin density of 0.1775 (CV=0.463) animals/km² and an abundance of 11,611 (95% CI=3,875-21,601) (Gilles *et al*. 2023). This is an increase from the Block T density and abundance estimate from the 2016 SCANS III survey of 0.037 (CV=0.295) animals/km² and 2,417 individuals (95% CI = 595-5,091) (Hammond *et al*. 2021). Using the SCANS III data Lacey *et al*. (2022) predicted a white-beaked dolphin surface density of 0.0-0.05 animals/km² along the east coast of Shetland, with higher predicted densities to the north and northwest. Nine white-beaked dolphins were sighted during the first eight months of the site-specific DAS (April – September 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c) (Figure 10.3). The Array Areas and OfECC is within the Celtic and Greater North Seas MU, which has an estimated 24,025 (95% CI=20,026-57,807; CV=0.28) animals in the UK portion of the MU (IAMMWG, 2023). Smith *et al.* (2021), carrying out land-based surveys over nine years, reported no white-beaked dolphin in the area. The conservation status of white-beaked dolphin within UK waters is unknown due to insufficient data to establish a population trend (JNCC, 2019b).

10.5.1.1.3 Risso's dolphin

Risso's dolphins are present year-round and are regularly sighted in northern Scotland and within Shetland waters (Hague *et al.* 2020). SCANS-IV Block NS-E has an estimated Risso's dolphin density of 0.0702 (CV=0.974) animals/km² and an abundance of 4,589 (95% CI=31-6,458) (Gilles *et al.* 2023). In the 2016 SCANS III survey no Risso's dolphins were sighted in Block T (Hammond *et al.* 2021), therefore no surface density estimates are available in Lacey *et al*. (2022). No Risso's dolphins have been identified in the eight months of site-specific DAS analysed to date (April – November 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c). There is an abundance estimate of 8,687 (CV=0.63; 95% CI=2,810-26,852) Risso's dolphin within the UK portion of the Celtic and Greater North Seas MU (IAMMWG, 2023). Smith *et al.* (2021), carrying out land-based surveys over nine years, reported Risso's dolphins on two occasions, one count with five individuals and another count with 20 individuals. The conservation status of Risso's dolphin within UK waters is unknown due to insufficient data to establish a population trend (JNCC, 2019c).

10.5.1.1.4 White-sided dolphin

Atlantic white-sided dolphins are present throughout the year in northern Scotland, particularly in the deep waters to the west of Shetland (Hague *et al.* 2020). SCANS-IV Block NS-E has an estimated Atlantic white-sided dolphin density of 0.0146 (CV=1.028) animals/km² and an abundance of 958 (95% CI=5-3,583) (Gilles *et al.* 2023). This is a decrease from the Block T density and abundance estimate from the 2016 SCANS III survey of 0.0209 (CV=0.984) animals/km² and 1,336 individuals (95% CI = 0-5,031) (Hammond *et al.* 2021). No surface density estimates are available for white-sided dolphin in Lacey *et al.* (2022) due to lack of data to allow modelling. No white-sided dolphins have been identified in the first eight months of site-specific DAS analysed to date (April – November 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c). There is an abundance estimate of 12,293 (CV=0.64; 95% CI=3,891-38,841) white-sided dolphin within the UK portion of the Celtic and Greater North Seas MU (IAMMWG, 2023). Smith *et al.* (2021), carrying out land-based surveys over nine years, reported no white-sided dolphins in the area. The conservation status of white-sided dolphin within UK waters is unknown due to insufficient data to establish a population trend (JNCC 2019d).

10.5.1.1.5 Minke whale

Minke whales are the most abundant baleen whale in the British Isles and within Shetland waters, where they are regularly sighted (Hague *et al.* 2020). SCANS-IV Block NS-E has an estimated minke whale density of 0.0121 (CV=0.9121) animals/km² and an abundance of 795 (95% CI=3-2,673) (Gilles *et al.* 2023). This is a decrease from the Block T density and abundance estimate from the 2016 SCANS III survey of 0.0316 (CV=0.805) animals/km^2 and 2,068 individuals (95% CI = 290-6,960) (Hammond *et al.* 2021). Using the SCANS III data Lacey *et al*. (2022) predicted a minke whale density of 0.02-0.05 in the Array Areas and 0.01-0.02 within the OfECC. Three minke whales have been identified in the eight months of site-specific DAS analysed to date (April – November 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c). The Array Areas and OfECC is within the Celtic and Greater North Seas MU, which has an estimated minke whale abundance of 10,288 (95% CI=6,210-17,042; CV=0.26) animals in the UK portion of the MU (IAMMWG, 2023). Smith *et al.* (2021), carrying out land-based surveys over nine years, reported four minke whale sightings in the area. The conservation status of minke whales within UK waters is unknown due to insufficient data to establish a population trend (JNCC 2019e).

10.5.1.1.6 Killer whale

Killer whales (*Orcinus orca*) are present within Shetland waters year-round with increased presence over the summer months, where they are regularly sighted in near-shore, coastal waters (ORCA, 2023; SWF, 2023). No surface density or abundance estimates are available for killer whales from the SCANS-III or SCANS-IV surveys (Gilles *et al.* 2023; Hammond *et al.* 2021), additionally there is no management unit identified and therefore no abundance estimate available (IAMMWG (2023). No killer whales have been identified in the eight months of site-specific DAS analysed to date (April – November 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c). Killer whales present in Shetland and northern Scotland are part of a North Atlantic community of killer whales, which are site-faithful, and individuals have been recorded in the region over consecutive years (Bolt *et al.* 2009; Foote *et al.* 2010; Hague *et al.* 2020). Individuals sighted off Shetland have been included in the Scottish Killer Whale Photo ID Catalogue (Scullion *et al.* 2021) which provides an indication on the numbers of killer whales and groups. Additionally, there is evidence of connectivity with individuals in Iceland and locations off the West coast of Scotland (Mrusczok and Scullion, 2019). Land based marine wildlife surveys carried out for the Shetland tidal array in Bluemull Sound, Shetland, over the nine-year programme reported one sighting, which was a group of 10 killer whales (Smith *et al.* 2021). The conservation status of killer whales in the UK is unknown due to insufficient data to establish population trends for the species (JNCC, 2019f).

10.5.1.1.7 Humpback whale

Humpback whales are occasionally sighted off Shetland with sightings throughout summer 2023 recorded off Levenwick and Mousa Sound (Nature in Shetland, 2023). No surface density or abundance estimates are available for humpback whales from the SCANS-III or SCANS-IV surveys (Gilles *et al.* 2023; Hammond *et al.* 2021), additionally there is no management unit identified and therefore no abundance estimate (IAMMWG, 2023). No humpback whales have been identified in the eight months of site-specific DAS analysed to date (April – November 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c). Humpback whale has been scoped in on a precautionary basis following the Marine Mammal Scoping Workshop on 28 November 2023 and advice from the Statutory Nature Conservation Bodies (SNCBs). The evidence base for their presence and occurrence around Shetland will be assessed in the marine mammal baseline report and given the lack of

density and abundance estimates, it is anticipated they will not be subjected to quantitative assessment. Other low frequency cetaceans will be assessed and therefore any mitigation measures will also apply to humpback whales, irrespective of whether they have been assessed quantitatively in the EIAR.

10.5.1.2 Pinnipeds

Two seal species, harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*), are present in Scotland and within Shetland waters year-round. Harbour seals are the most common of the two species in the region.

10.5.1.2.1 Harbour seal

Harbour seals in the UK have been assessed as having an unfavourable-inadequate conservation status (JNCC, 2019g). The harbour seal population in Scotland has experienced major declines, with an estimated 47% decline in Shetland since the late 1990's (SCOS, 2023). The Scoping boundary is within the Shetland Seal Management Unit (SMU) and falls within subunit five, which was last surveyed in 2019 (SCOS, 2023). The latest August count of harbour seals within the Shetland SMU is 3,180 individuals from surveys 2016-2019 (SCOS, 2023). Within sub-units 4 and 5, there were 216 and 285 individuals counted, respectively (SCOS, 2023). The latest population estimate for harbour seals in the Shetland SMU is 4,416 (95% CI=3,613-5888) which is considered to be depleted and still declining (SCOS, 2023). The habitat preference maps in Carter *et al*. (2020; 2022) show highest densities around the coastal waters of Shetland (Figure 10.4). No harbour seals have been identified in the eight months of site-specific DAS analysed to date (April – November 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c). Smith *et al*. (2021), carrying out land-based surveys over nine years, reported that nine harbour seals were sighted in the Shetland tidal array.

10.5.1.2.2 Grey seal

Grey seals in the UK have been assessed as having a favorable conservation status with an improving conservation status trend (JNCC, 2019h). Grey seals in Shetland have experienced fluctuations in population, with recent decreases in August count numbers and reduced pup production (SCOS, 2023). The latest August count of grey seals in 2019 within the Shetland SMU is 1,009 individuals. Within sub-units 4 and 5 there were 344 and 49 individual grey seals counted, respectively (SCOS, 2023). There is no estimated trend for grey seals within the Shetland SMU (SCOS, 2023). The habitat preference maps in Carter *et al*. (2020; 2022) show highest densities around Orkney (Figure 10.5). One grey seal has been identified in the eight months of site-specific DAS analysed to date (April – November 2023) (HiDef 2023a, HiDef 2023b, HiDef 2023c) (Figure 10.3). Smith *et al*. (2021) carried out land-based surveys over nine years and reported that two grey seals were sighted in the Shetland tidal array area vantage point surveys.

10.5.2 Landfall

Seals use coastal areas to haul-out of the water to rest, and during the annual moult and breeding season, and are particularly vulnerable to disturbance during these times.

Harbour seals haul-out on sandbanks and rocky areas, often in estuarine environments. The harbour seal breeding season is between June and July, and they haul-out to moult throughout August. Harbour seals are known to forage up to ca. 100 km from their nearest haul-out site, although typically they remain within 30-50 km of the coastline (Hague *et al.* 2020; SCOS, 2022).

Grey seals in the UK haul-out on a range of habitats, including remote islands and coastal areas, covering sandy beaches and rocky and rugged terrain. Female grey seals are known to show high site fidelity to breeding sites and colonies, and often return to breed at the same colony in which they were born (SCOS, 2022). The grey seal breeding season in north Scotland is between September and late November, and they haul-out to moult between December and April (SCOS, 2022). Grey seals are known to forage offshore within 100 km of haul-out sites (Carter *et al.* 2022; Hague *et al.* 2020; SCOS, 2019).

Within the Project's Scoping Boundary there are 48 designated seal haul-out sites. These sites do not differentiate between species, therefore they are applicable to harbour seal and grey seal.

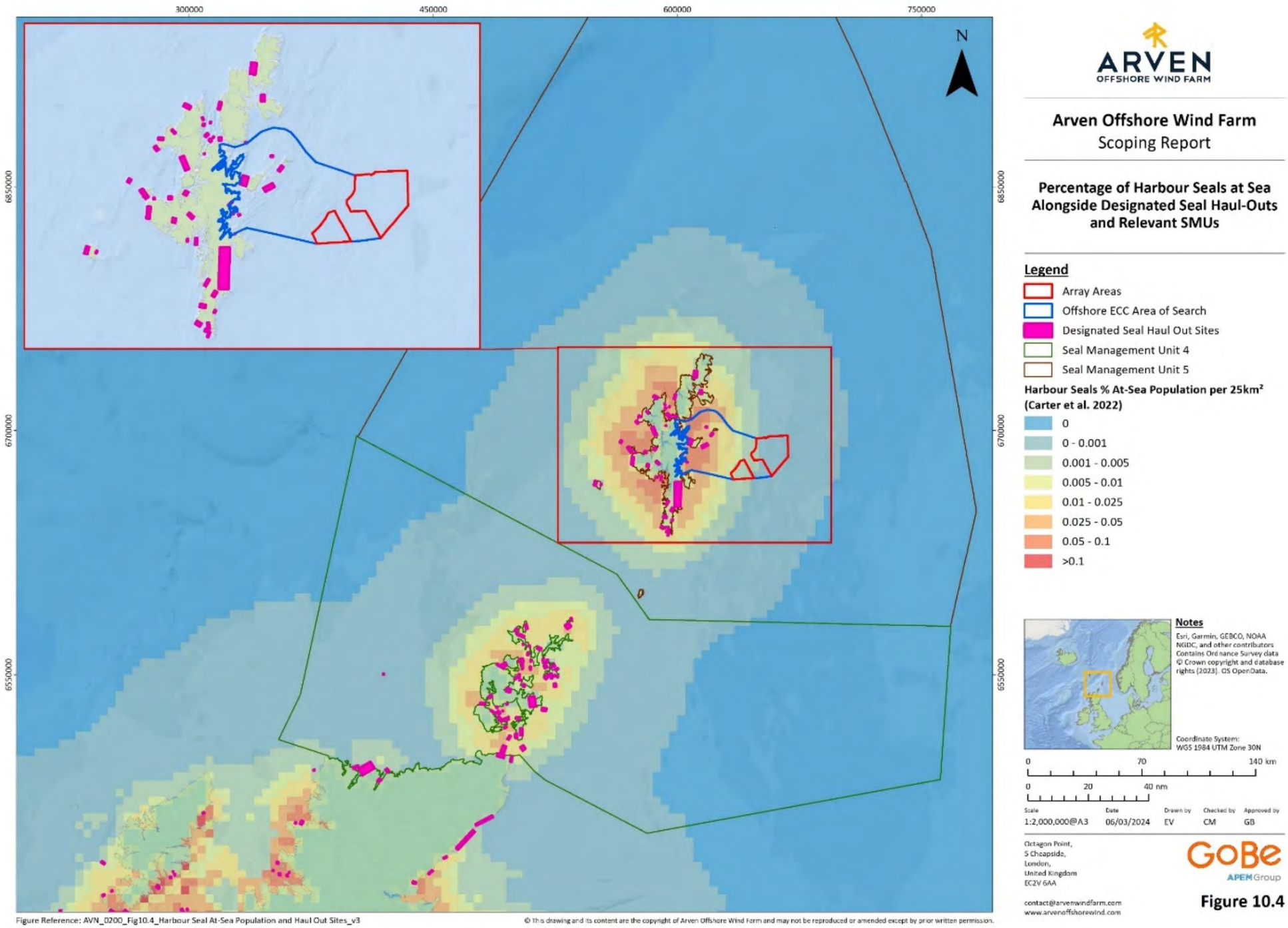
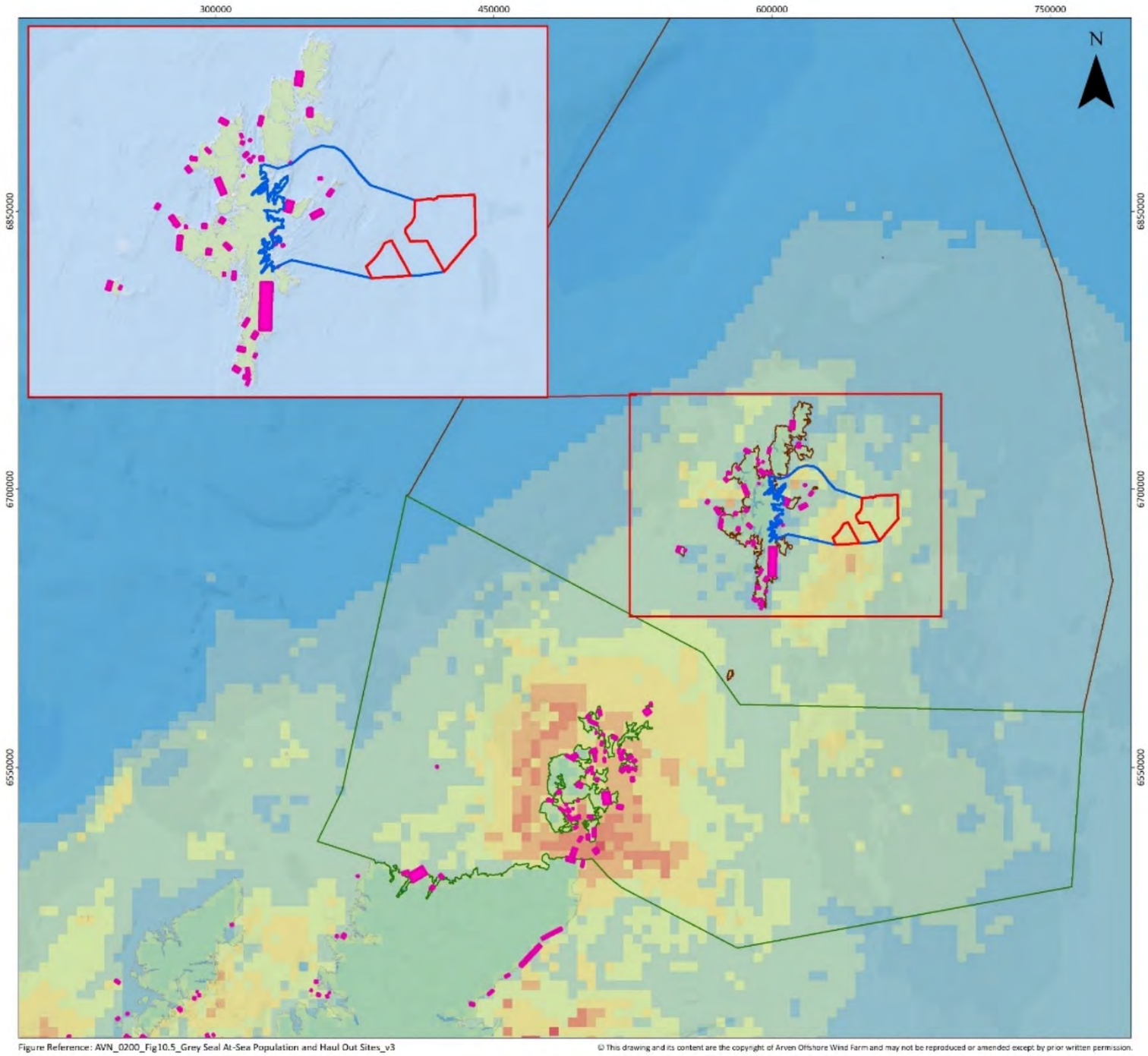


Figure 10.4: Harbour Seal % of British Isles At-Sea Population Alongside Designated Harbour Seal Haul-Out Sites for Shetland, Orkney and North Coast SMUs



ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

Percentage of Grey Seals at Sea Alongside Designated Seal Haul-Outs and Relevant SMUs

Legend

- Array Areas
- Offshore ECC Area of Search
- Designated Seal Haul Out Sites
- Seal Management Unit 4
- Seal Management Unit 5

Grey Seals % At-Sea Population per 25km² (Carter et al. 2022)

- 0
- 0 - 0.001
- 0.001 - 0.005
- 0.005 - 0.01
- 0.01 - 0.025
- 0.025 - 0.05
- 0.05 - 0.1
- >0.1

Notes

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System:
WGS 1984 UTM Zone 30N

0 70 140 km
0 20 40 nm

Scale	Date	Drawn by	Checked by	Approved by
1:2,000,000@A3	06/03/2024	EV	CM	GB

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APEM Group

Figure 10.5

Figure Reference: AVN_0200_Fig10.5_Grey Seal At-Sea Population and Haul Out Sites_v3

Figure 10.5: Grey Seal % of British Isles At-Sea Population Alongside Designated Grey Seal Haul-Out Sites for Shetland, Orkney and North Coast SMUs

10.5.3 Designated Sites

10.5.3.1 Cetaceans

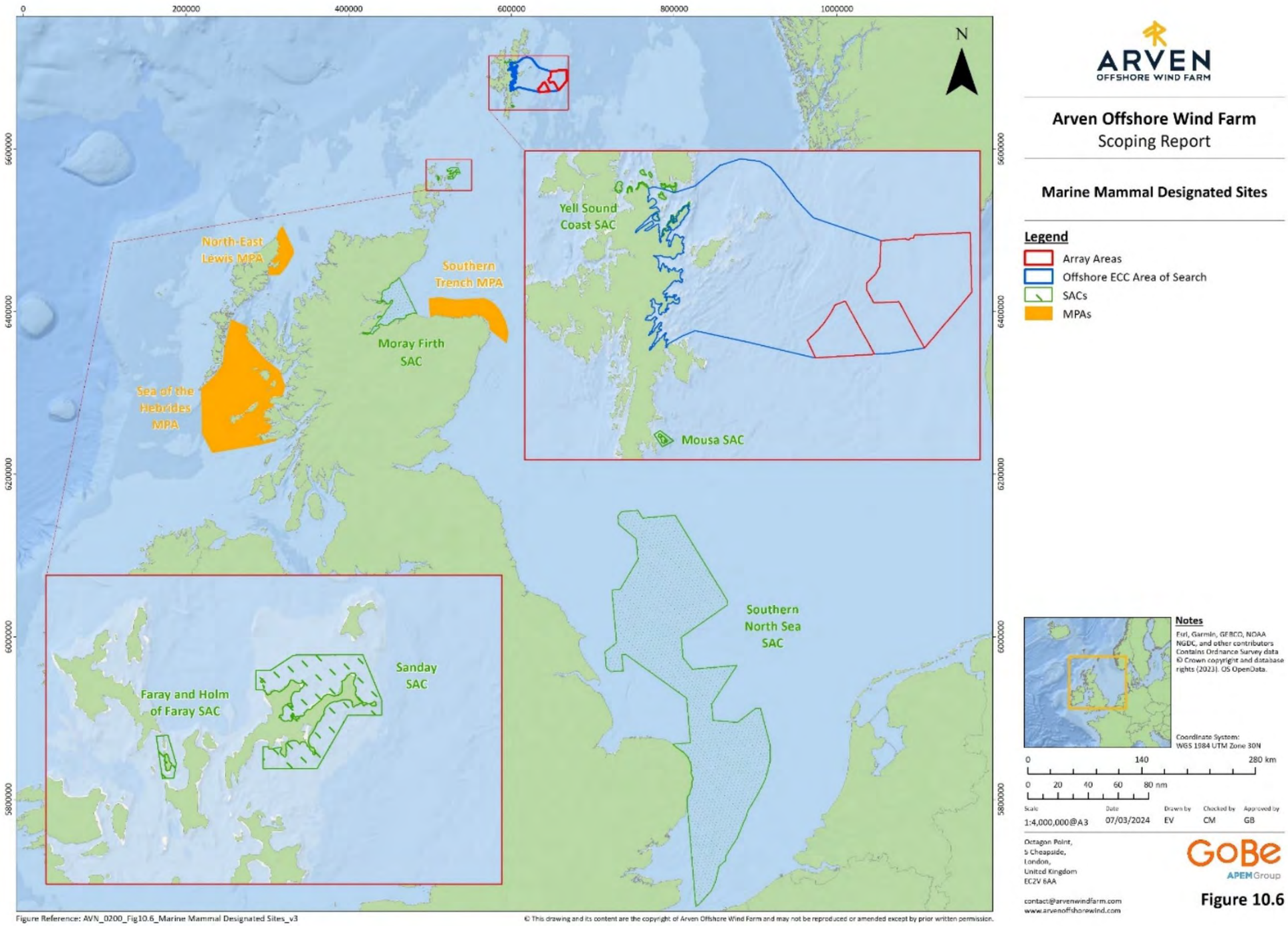
All cetaceans are classed as EPS and are protected under UK law. As detailed in Chapter 2: Legislation and Policy Context, under the Habitats Directive and implementing domestic legislation, European sites have been established to protect species. The designation of SACs is a requirement for Annex II species, including harbour porpoise, bottlenose dolphin, grey seal, and harbour seal. There are no designated SACs for cetaceans that overlap with the Array Areas and OfECC, or within Shetland waters. The closest SAC for cetacean species that are scoped in is the Southern North Sea SAC which is designated for harbour porpoise and located 525 km from the Array Areas. The closest MPA for cetaceans is the Southern Trench MPA, which is designated for minke whales and located 262 km away from the Array Areas (Table 10.3). The approach to screening in protected sites is precautionary at this stage and has considered the respective MU for the marine mammal species scoped in (i.e. the regional study area). For some species, given the size of MUs this has identified protected sites that are more than 500 km from the Array Areas (Table 10.3).

10.5.3.2 Pinnipeds

Both harbour and grey seals are Annex II species which require the designation of SACs for their protection. Harbour seals are listed as the primary reason for site selection for two SACs in Shetland: Yell Sound Coast SAC, which overlaps with the Scoping Boundary, and Mousa SAC, which is 28 km from the Offshore Array Areas (Table 10.3). In the wider North Sea and northern Scotland region, harbour seals are also listed as the primary reason for site selection in the Sanday SAC, Dornoch Firth and Morrich More SAC, and Firth of Tay and Eden Estuary SAC (Table 10.3) (Figure 10.6).

There are no SACs for grey seal in Shetland, however in the wider region, grey seals are listed as the primary reason for site selection in the Faray and Holm of Faray SAC, North Rona SAC, Isle of May SAC and the Berwickshire and North Northumberland Coast SAC (Table 10.3) (Figure 10.6).

Shetland has recently been recognized as an Important Marine Mammal Area (IMMA), with qualifying species including harbour seal, harbour porpoise, grey seal, killer whale, minke whale and humpback whale. The IMMA is not a legal designation but identified in order to prioritise their consideration for conservation measures by governments and other relevant organisations. The IMMA overlaps with the marine mammal study areas and potential impacts on the IMMA qualifying features will be assessed in EIA.



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Scoping Report

Marine Mammal Designated Sites

Legend
- Array Areas
- Offshore ECC Area of Search
- SACs
- MPAs

Notes
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System:
WGS 1984 UTM Zone 30N

0 140 280 km
0 20 40 60 80 nm

Scale	Date	Drawn by	Checked by	Approved by
1:4,000,000@A3	07/03/2024	EV	CM	GB

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Figure 10.6

Figure 10.6: Marine Mammal Designated Sites

Table 10.3: Designated sites for Marine Mammals in relation to the proposed Offshore Array Areas

Species	Designated site	Population / count	Potential site trends	Distance from Offshore Proposed Development	Reference(s)
Bottlenose dolphin	Moray Firth SAC	Population estimate: 224	Stable	526 km	Cheney *et al.*, 2018; IAMMWG, 2022
Harbour porpoise	Southern North Sea SAC	Population estimate: 27,936	Stable	525 km	IAMMWG, 2023
Minke whale	Sothern Trench MPA	Unknown	Unknown	262 km	-
	Sea of Hebrides MPA	Unknown	Unknown	459 km	-
Harbour seal	Yell Sound Coast SAC	2019 count: 208	Stable	0 km	SCOS 2022, 2023
	Mousa SAC	2019 count: 7	Declining	28 km	SCOS 2022, 2023
	Sanday SAC	2019 count: 77	Declining	139 km	SCOS 2022, 2023
Grey seal	Faray and Holm of Faray SAC	2019 count: 228	Declining	162 km	SCOS 2022, 2023
Risso's dolphin	Northeast Lewis MPA	2017: count 117	Unknown	356 km	Weir *et al.*, 2019

10.6 Embedded Mitigation

As part of the initial design process, embedded mitigation measures are proposed to reduce the potential environmental effects of the Project. Measures related to Marine Mammals are as follows:

- C-1: Development of a CaP – Development of and adherence to CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
- C-6: Development of and adherence to an EMP. The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: Chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management.
- C-8: Appointment of an Environmental Clerk of Works (EcoW). The EcoW will monitor compliance with granted consents.
- C-9: Development of and adherence to a MPCP. The MPCP will identify potential sources of pollution and associated spill response and reporting procedures.
- C-11: Development of and adherence to a PS (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.
- C-12: Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction Project phases.
- C-13: Development of and adherence to a VMP. The VMP will confirm the types and numbers of vessels that will be engaged on the Project and consider vessel coordination including indicative transit route planning.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.

10.7 Scoping of Impacts

10.7.1 Potential Impacts Scoped In

The potential impacts to marine mammals from the construction, O&M, and decommissioning phases of the Offshore Proposed Development have been identified in Table 10.4.

Table 10.4: Impacts scoped into the assessment of Marine Mammals

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Construction and Decommissioning			
Underwater noise impacts from piling	Underwater noise generated from piling has the potential to result in auditory injury in the form of a permanent threshold shift (PTS) in hearing. Additionally piling has the potential to have an impact on individuals and populations via a temporary threshold shift (TTS) in hearing, behavioural disturbance and/or displacement.	Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with Maximum Design Scenario. Worst case underwater noise modelling locations in the Array Areas will be selected based on perceived impacts to marine mammal receptors and will consider variables such as proximity to designated sites or depth contours. The outputs of underwater noise modelling will be used to understand the impacts on marine mammals and determine significance of effects, with reference to noise exposure guidelines.	C-11 (PS)
Underwater noise from UXO clearance	Underwater noise generated from UXO clearance[7] has the potential to result in auditory injury in the form of PTS. Additionally, UXO clearance has the potential to have an impact on individuals and populations via a temporary threshold shift (TTS) in	Underwater noise modelling and impact ranges from UXO clearance is available from monitoring at other developments. A range of charge weights will be presented and assessed for impacts to marine mammals, with	C-12 (PEMP)

[7] UXO clearance will be licenced under a separate Marine Licence and EPS Licence application

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
	hearing, behavioural disturbance and/or displacement. Whilst low order clearance (e.g. deflagration) techniques are understood to exist, for underwater noise modelling high order clearance would be modelled as a worst-case scenario.	the maximum charge weight being informed by other developments in the area. The impact ranges will be used to understand the impacts on marine mammals and determine significance of effects, with reference to noise exposure guidelines.	
Underwater noise impacts from other construction activities	Underwater noise generated from geophysical surveys and other construction activities such as cable laying, dredging, and trenching have the potential to result in auditory injury (PTS), TTS in hearing, behavioural disturbance and/or displacement.	Impact ranges from geophysical surveys and other construction activities are available from monitoring at other developments and will be used to understand the impacts on marine mammals and determine significance of effects, with reference to noise exposure guidelines.	C-6 (EMP)
Indirect impacts on marine mammal prey species from underwater noise	Impacts from construction and decommissioning activities on fish and shellfish receptors could lead to changes in prey availability, distribution and abundance and, as a result, potentially impact on marine mammal foraging success. In particular, underwater noise impacts from piling, UXO clearance, geophysical surveys and other construction activities may lead to mortality, injury or disturbance to prey populations.	Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with the Maximum Design Scenario. The impacts to prey species will be assessed using the noise modelling outputs and the noise exposure guidelines. Indirect effects on fish as prey will be inferred from these outputs.	Listed in Chapter 9: Fish and Shellfish Ecology.

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
Collision risk associated with increased vessel traffic in the Array Areas and OfECC	Increased vessel presence in the area associated with the development could lead to a potential increase in collision risk with marine mammals. Whilst collision risk is unlikely, the potential severity of injury can range from minor (recoverable) to major (mortality).	Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Maximum Design Scenario.	C-13 (VMP)
Disturbance impacts associated with increased vessel traffic in the Array Areas and OfECC	There will be an existing baseline for vessel traffic in the area comprised of passenger, cargo and other vessel types. Increased vessel presence in the area associated with the development could lead to a potential increase in disturbance and/or displacement of marine mammals.	Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Maximum Design Scenario.	C-13 (VMP)
Disturbance at haul-out sites	There are seal haul-outs close to the OfECC and Landfall areas of search and so there is the potential for disturbance.	Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Maximum Design Scenario.	C-13 (VMP)
Operation and Maintenance			
Indirect impacts on marine mammal prey species from underwater noise	Impacts from O&M activities on fish and shellfish receptors could lead to changes in prey availability (e.g. distribution and abundance) and, as a result, potentially impact on marine mammal foraging success.	Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with the Maximum Design Scenario. The impacts to prey species will be assessed using the noise modelling outputs and the noise exposure guidelines. Indirect	Listed in Chapter 9: Fish and Shellfish Ecology.

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
		effects of fish as prey will be inferred from these outputs.	
Collision risk associated with increased vessel traffic in the Array Areas and OfECC	Increased vessel presence in the area associated with the development could lead to a potential increase in collision risk with marine mammals. Whilst collision risk is unlikely, the potential severity of injury can range from minor (recoverable) to major (mortality).	Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Maximum Design Scenario.	C-13 (VMP)
Disturbance impacts associated with increased vessel traffic in the Array Areas and OfECC	There will be an existing baseline for vessel traffic in the area comprised of passenger, cargo and other vessel types. Increased vessel presence in the area associated with the development could lead to a potential increase in disturbance and/or displacement of marine mammals.	Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Maximum Design Scenario.	C-13 (VMP)
Disturbance at haul-out sites	There are seal haul-outs close to the OfECC and Landfall areas of search and so there is the potential for disturbance.	Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Maximum Design Scenario.	C-13 (VMP)
Noise related impacts associated with Floating foundations	It is anticipated that impacts relating to noise associated with floating foundations would be negligible to marine mammals; however, there is uncertainty associated with floating offshore wind, new technologies and limited monitoring data, so this impact has been scoped in. This is in line with	Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with the Maximum Design Scenario. The outputs of underwater noise modelling will be used to assess the impacts on marine mammals and determine	-

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
	Scottish Ministers, Marine Scotland Science and NatureScot representations advice in recent Scoping Opinions (Marine Scotland, 2022; Marine Scotland 2023; Marine Directorate 2023a; Marine Directorate 2023b).	significance of effects, with reference to noise exposure guidelines	
Injury risk from entanglement of marine mammals with WTG mooring line and cables (primary interaction), and/or with discarded fishing gear wrapped around mooring lines (secondary interaction).	The effects of floating offshore wind and entanglement in mooring lines is poorly understood. However, focus on entanglement risk with floating wind is often on derelict or lost fishing gear, which has the potential to entangle with moorings and could lead to marine mammal entanglement. This is in line with consultation feedback for other projects, where the potential for entanglement with debris caught in mooring lines (indirect entanglement) was required to be included at EIA (Marine Scotland, 2021; Marine Scotland, 2023)	Impact assessment will be based on the worst-case scenario as detailed in the Maximum Design Scenario.	C-12 (PEMP)
Collision risk with Floating foundations	The floating substructure is still to be defined. The collision risk between marine mammals and these structures is thought to be negligible based on marine mammal behaviour but is poorly understood. Given this knowledge gap, this has been scoped in on a precautionary basis.	Impact assessment will be based on the worst-case scenario as detailed in the Maximum Design Scenario.	C-12 (PEMP)
Impacts on marine mammal prey species from	The potential EMF impacts on prey species may impact foraging for marine mammals. EMF impacts	Impact assessment will be based on the worst-case scenario as detailed in the Maximum	Listed in Chapter 9: Fish

Impact	Description	Proposed Assessment Approach	Embedded Mitigation
EMF due to subsea cable installation	on fish and shellfish (prey) species will be assessed in the Benthic and Intertidal Ecology and the Fish and Shellfish Ecology chapters at the EIAR stage.	Design Scenario and on the impact assessment presented in the Fish and Shellfish Ecology chapter in the EIA.	and Shellfish Ecology
Habitat change, displacement or barrier effects due to presence of WTG and mooring lines	The impacts of floating wind on marine mammals are poorly understood, with the introduction of new infrastructure, mooring lines and cables to the marine environment potentially resulting in the displacement or exclusion of marine mammals from an area. It is also possible there may be changes to habitat which influence the abundance and distribution of prey species.	Impact assessment will be based on the worst-case scenario as detailed in Maximum Design Scenario.	C-12 (PEMP)

10.7.2 Potential Impacts Scoped Out

The potential impacts scoped out for marine mammals from construction, O&M, and decommissioning phases of Offshore Proposed Development have been identified in Table 10.5.

Table 10.5: Impacts proposed to be scoped out of further assessment for Marine Mammals

Impact	Justification
Construction and Decommissioning	
Changes in water quality from activities in the Array Areas and OfECC	Activities relating to construction, operation and maintenance or decommissioning may influence water quality as a result of sediment disturbance, this is anticipated to be short-term and localised. Marine mammals are known to forage in tidal areas where water conditions are turbid and visibility is poor (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. Hearing, not vision, is the primary sensory modality for most marine mammal species. When the visual sensory systems of marine mammals are compromised, they can 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 low light levels.
Changes to water quality relating to accidental pollutant release	Accidental release of pollutants from spills or contaminant releases during construction or decommissioning may lead to mortality of marine mammals or reduction in prey availability. However, the implementation of an EMP (C-6) and MPCP (C-9) will mean that any impacts occurring from such events would not have impacts at the population level. It is also anticipated that if such an event did occur, it would be short-term and localised.
Operation and Maintenance	
Changes in water quality from activities in the Array Areas and OfECC	Activities relating to construction, operation and maintenance or decommissioning may influence water quality as a result of sediment disturbance, this is anticipated to be short-term and localised. Marine mammals are known to forage in tidal areas where water conditions are turbid and visibility is poor (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

Impact	Justification
	mammal foraging success. Hearing, not vision, is the primary sensory modality for most marine mammal species. When the visual sensory systems of marine mammals are compromised, they can 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 low light levels.
Changes to water quality relating to accidental pollutant release	Accidental release of pollutants from spills or contaminant releases may lead to mortality of marine mammals or reduction in prey availability. However, the implementation of an EMP (C-6) and MPCP (C-9) will mean that any impacts occurring from such events would not have impacts at the population level. It is also anticipated that if such an event did occur, it would be short-term and localised.
Impacts on marine mammals from EMF due to subsea cable installation	Subsea cables emit EMF, however existing evidence suggests that the levels of EMF emitted by offshore renewable energy export cables are at a low level, relative to this receptor group, such that there is no potential for direct significant impacts on marine mammals (Copping and Hemery 2020). To date, the only marine mammal species known to show any response to EMF is a non-UK species, the Guiana dolphin (*Sotalia guianensis*). This species has 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. EMF effects on potential prey species will be considered in the Benthic and Intertidal Ecology and Fish and Shellfish Ecology chapters of the EIAR.

10.8 Potential Cumulative Impacts

The process by which potential cumulative impacts will be assessed through the CIA is described in Chapter 4: EIA Methodology, which provides examples of the projects that are likely to be included in the assessment. For marine mammals the cumulative impacts will arise predominantly from underwater noise associated with construction activities at other offshore wind developments, including piling, UXO clearance and vessels. The closest OWF development to the Project is Stoura Offshore Wind Farm; should construction schedules overlap Stoura will be assessed in the marine mammal CIA. Additionally, the CIA will consider activities associated with other renewable projects (e.g., wave, tidal) and seismic surveys associated with the oil and gas industry. For each species the projects screened in will be those that overlap temporally with construction at the Offshore Proposed Development and are in the relevant MUs.

For each project screened in, the number of individuals impacted will be calculated based on the assumption of the Project's worst-case scenario as detailed in the Maximum Design Scenario, the assumptions relating to activity impact footprints and the densities of animals. For each year that the construction of offshore projects are planned, the maximum number of animals impacted will be presented alongside the proportion of the relevant MUs.

10.9 Potential Transboundary Impacts

The process by which potential transboundary impacts will be assessed is described in Chapter 4: EIA Methodology.

The following transboundary impacts have been identified as potentially resulting from activities associated with the Offshore Proposed Development's construction, O&M, and decommissioning stages:

- Underwater noise generated during construction and decommissioning, particularly installation and removal or turbines; and
- Disturbance to prey species as suspended sediment leads to disturbance and loss of spawning or nursey ground.

Whilst the site-specific marine mammal study area does not extend beyond the limits of Scottish or UK waters, the regional study area does as several MUs extend beyond the UK EEZ. Due to the wide ranging and mobile nature of marine mammals, there is the potential for transboundary impacts. During construction, behavioural disturbance from underwater noise could occur over tens of kilometers and there is, therefore, the potential for transboundary effects where underwater noise could extend into waters of EEA states or impact individuals associated with designated sites in other states.

10.10 Proposed Approach to EIA

10.10.1 Relevant Guidance

- IEEM guidelines for marine and coastal ecological impact assessment in Britain and Ireland (IEEM, 2010; CIEEM, 2019);
- European Union Guidance on wind energy developments on Natura 2000 legislation (European Commission 2021);
- OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008);
- Marine mammal PTS-onset criteria recommendation in Southall *et al*. (2019);
- Position statement from the Joint Statutory Nature Conservation Bodies in relation to the use of Acoustic Deterrent Devices (ADDs) for marine mammal mitigation during offshore wind farm construction (JNCC 2016);
- Guidance on mitigation protocols to minimise the risk of injury to marine mammals from piling noise (JNCC 2010a);
- Scottish Marine Wildlife Watching Code (SNH 2017);
- JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (seismic survey guidelines) (JNCC 2017);
- JNCC guidelines for minimising the risk of disturbance and injury to marine mammals whilst using explosives (JNCC 2010b);

- UK Government Policy paper: Marine environment: unexploded ordnance clearance joint interim position statement (2021, updated 2022);
- Guidance on the Offence of Harassment at Seal Haul-Out Sites (Marine Scotland 2014);
- The protection of Marine European Protected Species from injury and disturbance: Guidance for Inshore Waters (July 2020 Version) (Marine Scotland 2020);
- Description of Scottish Priority Marine Features (PMFs), commissioned Report (2016);
- The UK Post-2010 Biodiversity Framework and the Scottish Biodiversity Strategy: Revised Implementation Plan (2018-2020) (JNCC 2018)

10.10.2 Anticipated Additional Data Sources at EIA

For the baseline characterisation in the EIA a literature review will be undertaken; this will use and, where possible, build on the data sources in Table 10.2 and Section 10.3. Additional data sources include:

- Site-specific DAS to further inform the marine mammal baseline (i.e., sightings data and density estimates, where data allows);
- Additional assessments and reports linked to SCANS IV survey data;
- SCOS annual reports;
- Paxton *et al*. (in prep) Analyses relating to the abundance and distribution of selected marine mobile species in Scottish territorial waters;
- Scottish Passive Acoustic Network (SPAN) stations: Shetland South (#7) and Shetland North (#8);
- Site-specific static PAM deployments, which are currently being progressed by the Developer; and
- Additional data raised during the pre-Scoping workshop in November 2023 (Section 10.4).

10.10.3 Assessment Methodology

10.10.3.1 Underwater noise modelling

Underwater noise modelling using the INSPIRE model will be undertaken for piling, UXO clearance, other construction activities and operational noise planned to occur throughout the Offshore Proposed Development, likely focusing on piling and UXO clearance. This will be used to quantitively assess the risk of PTS, TTS and disturbance to marine mammals.

For piling, worst-case underwater noise modelling locations in the Array Areas will be selected to calculate the maximum potential impacts to marine mammal species across the relevant functional hearing groups. The methods will be fully detailed in the underwater noise technical report submitted as an appendix to the Marine Mammal and Fish Ecology chapters as part of the EIA.

Auditory injury from UXO clearance will assess the impact from PTS, TTS and disturbance to marine mammal species across the relevant functional hearing groups. The assessment will include both high-order clearance as a worst-case scenario and low-order clearance methods.

The assessment of other construction activities such as vessel noise, dredging and trenching will be assessed either qualitatively or quantitatively (i.e., modelled) as required, in the underwater noise technical report, which will be submitted as an appendix to the Marine Mammal and Fish Ecology chapters as part of the EIA.

10.10.3.2 Assessment of PTS using Southall et al. (2019)

To assess the risk of PTS and TTS, following best practice and current guidance, the thresholds presented in Southall *et al.* (2019) will be used. The assessment will be based on dual criteria of peak sound pressure level

(SPL_{peak}) and cumulative sound exposure level (SEL_{cum}). SPL_{peak} is used to characterise sound from impulsive sources such as percussive impact piling and is the unweighted received sound level. SEL_{cum} considers the cumulative aspect of multiple pulses within a time frame and is frequency weighted, to reflect the hearing sensitivity of each functional hearing group.

10.10.3.3 Assessment of disturbance from UXO

UXO clearance will be assessed as part of the impacts to marine mammals that arise during the construction phase. However, UXO clearance will be licensed as part of a separate Marine Licence (and EPS licence) application. The UXO ID campaign will not have taken place at the time of the EIAR, therefore the number and size of UXOs requiring clearance will not be known. The EIA will present an indicative worst-case scenario for number and charge sizes informed by knowledge on previous UXO surveys for other developments in the North Sea and publicly available data sources such as OSPAR encounters with munitions[8].

10.10.3.4 Assessment of disturbance from piling

A species-specific dose response curve will be used, as opposed to a fixed behavior approach. Dose response curves are only available for harbour porpoise (Graham *et al.* 2017) and harbour seal (Whyte *et al.* 2020) at present. For other species, those for harbour porpoise and harbour seal will be used as a proxy. For this assessment, the contours (at appropriate dB intervals) from the underwater noise modelling will be overlaid on the relevant species density surface maps to predict the number of individuals potentially disturbed. Where possible, a quantitative assessment of population consequences of disturbance will be undertaken using an appropriate approach (e.g. iPCoD) (Harwood *et al.* 2013).

10.10.3.5 Assessment of vessel collision and disturbance

Assessing impacts of vessel collision and disturbance will be based on the Project parameters and information in scientific literature, relevant reports, and guidance. For example, for likelihood and impacts of vessel collision, information will be drawn from UK Cetacean Strandings Investigation Program and Scottish Marine Animal Stranding Scheme. With respect to vessel disturbance, guidance and the most relevant and recent research (e.g., Benhemma-Le Gall *et al*. (2021)) will be considered.

10.10.3.6 Assessment of disturbance from other construction activities and operations

For disturbance from other construction activities the assessment will be based on noise levels for each activity and/or equipment type, and information in scientific literature, relevant reports, and guidance on impact ranges. For assessment of disturbance due to operational noise, this will be based on publicly available information and data from other floating offshore wind farms.

[8] https://odims.ospar.org/en/search/?search=munitions

10.10.3.7 Assessment of entanglement

The assessment of entanglement will be qualitative and based on publicly available evidence from other floating offshore wind farms and studies, whilst considering the Maximum Design Scenario and the behaviour and abundance of the species scoped into the assessment.

10.11 Scoping Questions

The following scoping questions refer to the marine mammals chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the site-specific study area and the species-specific regional study areas used for Marine Mammals?
- Do you agree with the use of those data listed in Section 10.3, and any additional anticipated data listed in Section 10.10, being used to inform the Offshore EIA? Have any relevant data sources and/or references been omitted from these Sections?
- Do you agree that all relevant Marine Mammal species have been scoped in?
- Do you agree with the scoping in and out of impacts related to Marine Mammals?
- Do you agree on the suitability of proposed Embedded Mitigation of relevance to Marine Mammals that have been identified for the Offshore Proposed Development?
- Do you agree with proposed approach to the assessment of transboundary effects related to Marine Mammals?
- Do you agree with the proposed approach to assessment of cumulative effects related to Marine Mammals?
- Do you agree with the proposed assessment methodology related to Marine Mammals?

11 Offshore Ornithology

11.1 Introduction

This chapter identifies the offshore ornithology receptors of relevance to the Offshore Proposed Development and the potential impacts of the construction, O&M, and decommissioning phases of the Offshore Proposed Development upon those receptors. The chapter considers both the offshore and intertidal components of the Offshore Proposed Development seaward of MHWS.

Offshore ornithological receptors are those that naturally occur at sea and may have the potential to be affected by offshore renewable energy developments. This includes those species classed as 'seabirds', plus migratory species such as geese and swans as well as waders, raptors, and passerines.

Given that there is a relationship between marine and intertidal ornithology and fish and shellfish populations (some bird species featured in this chapter are piscivorous), this chapter should be read alongside Chapter 9: Fish and Shellfish Ecology.

This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants.

11.2 Study Area

The offshore ornithology study area is presented in Figure 11.1 and is defined spatially by the Offshore Proposed Development's footprint plus a 6 km buffer.

The buffer for the Array Areas has been defined in line with SNCB advice (Nature Scot, 2023b & JNCC and SNCBs, 2022) and reflects the buffer applied to ongoing digital aerial surveys (DAS), for which a survey methodology was agreed with NatureScot in 2023. A refined OfECC is yet to be defined within the Area of Search; once defined, associated impact pathways – plus an appropriate displacement buffer - will also be refined and an adjusted study area is expected to result.

In identifying offshore ornithology receptors and potential impacts upon them, this scoping exercise accounts for the highly mobile nature of bird species and recognises that birds from nesting sites outside of the study area may also travel to the study area for feeding, loafing, moulting, overwintering, or migration.

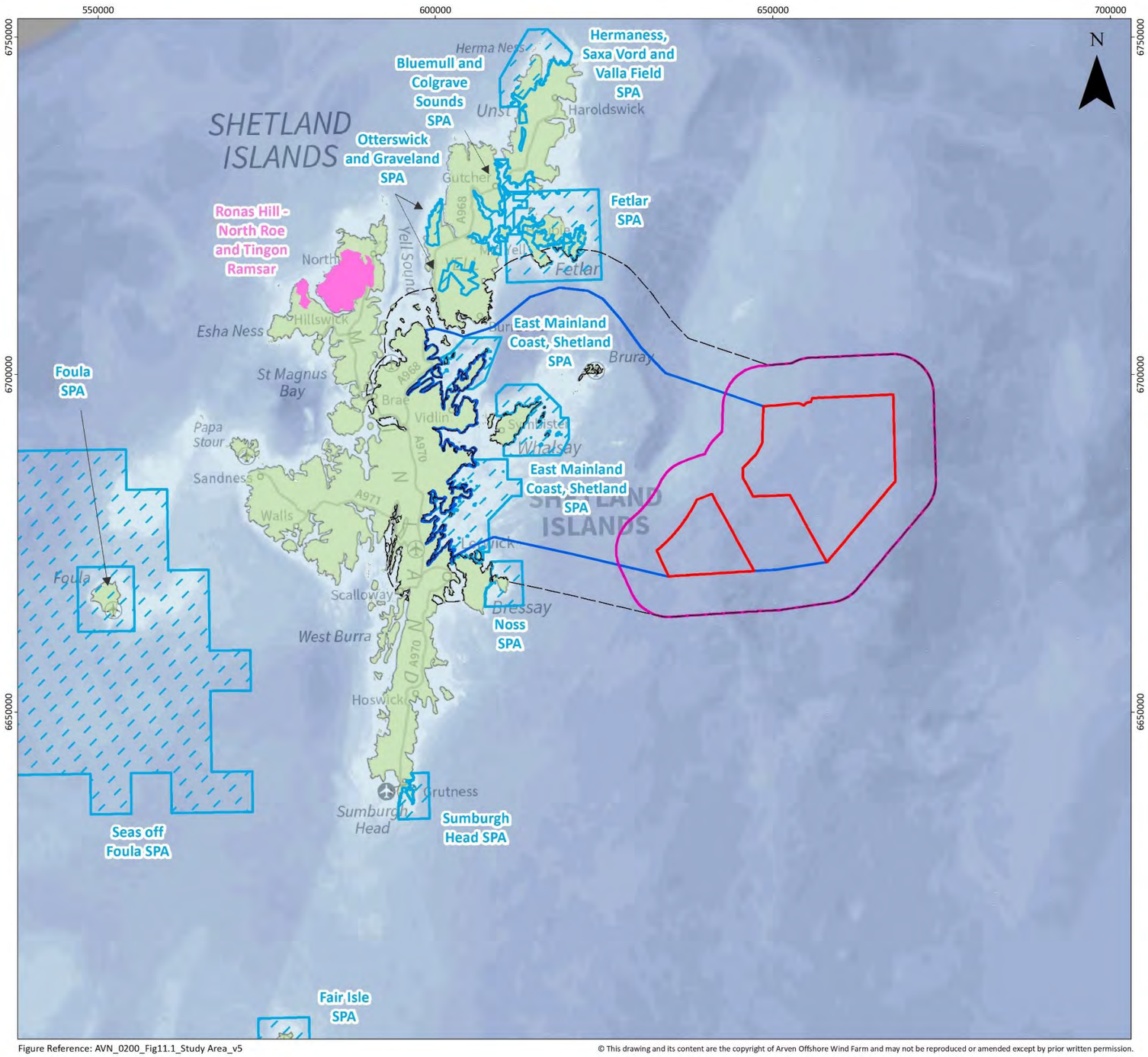

Figure Reference: AVN_0200_Fig11.1_Study Area_v5

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Scoping Report

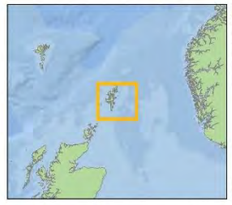
Ornithology Study Area

Legend

- Array Areas
- Offshore ECC Area of Search
- Ornithology Study Area - 6km Buffer
- 6km Array Areas Buffer
- SPAs
- Ramsar

Depth (m)

- 0 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 110
- 110 - 120
- 120 - 130
- 130 - 140
- 140 - 150
- 150 - 160
- 160 - 170
- 170 - 180
- 180 - 190
- 190 - 200
- >200



Notes

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System:
WGS 1984 UTM Zone 30N

0 10 20 km
0 5 10 nm

Scale	Date	Drawn by	Checked by	Approved by
1:550,000 @A3	08/05/2024	EV	CM	GB

Octagon Point,
5 Cheapside,
London,
United Kingdom
EC2V 6AA

contact@arvenwindfarm.com
www.arvenoffshorewind.com

GoBe
APEM Group

Figure 11.1

Figure 11.1: Offshore Ornithology Study Area

11.3 Data Sources at Scoping

An overview of the baseline environment has been presented based on a desk-based review of relevant literature and datasets. These sources of information cover both the study area and the wider region to provide a contextualized view of the environment and potential receptors surrounding the Offshore Proposed Development. These sources are presented in Table 11.1.

Site-specific DAS commissioned by the Developer are currently being conducted, with six months of density and abundance data provided to inform this scoping exercise (Table 11.3). The Developer also commissioned seabird colony count surveys for two key Shetland SPAs in 2023. The data collected via these surveys, alongside other publicly available data sources, has helped identify key bird species which may have potential interactions with the Offshore Proposed Development.

Table 11.1: Data sources used to inform the Offshore Ornithology scoping chapter

Title	Summary	Source	Author and year
Project Specific Data			
Site-specific DAS surveys for the Offshore Proposed Development 2023 to 2025	Site-specific baseline characterisation digital video aerial surveys (24 surveys between April 2023 and March 2025). Six months of data (April 2023 – September 2023) was available to inform this Offshore Scoping Report. Survey method agreed with NS.	The Developer	HiDef, ongoing
Project Arven – Seabird Colony Surveying 2023	Seabird colony counts for Noss SPA and Hermaness, Saxa Vord and Valla Field SPA in 2023. Survey method notified to NS.	The Developer	HiDef, 2023
Existing Regional Data			
Shetland Local Development Plan: Appendix III SEA Environmental Baseline	Report	https://www.shetland.gov.uk/downloads/file/4786/appendix-iii-environmental-baseline	Shetland Islands Council (SIC); 2022.

Title	Summary	Source	Author and year
Shetland Islands Marine State of the Environment Assessment	Report	https://www.shetland.uhi.ac.uk/t4-media/one-web/uhi-shetland-images-and-documents/research/document/marine-spatial-planning/state-of-environment-assessment/shetland-state-of-the-marine-environment-assessment-april-17.pdf	Shucksmith, 2017
SOTEAG Monitoring reports	Report	SOTEAG - https://soteag.org.uk/environmental-monitoring/monitoring-reports/	SOTEAG, multiple years
UK seabird colony counts in 2023 following the 2021-22 outbreak of Highly Pathogenic Avian Influenza	Report	RSPB Research Report 76, Tremlett *et al*, 2024. https://www.rspb.org.uk/birds-and-wildlife/seabird-surveys-project-report	RSPB, 2024
Seabirds Count: A census of breeding seabirds in Britain and Ireland (2105-2021)	Dataset, report	Burnell *et al*, 2023 https://www.lynxeds.com/product/seabirds-count/	JNCC, 2023
POSEIDON DAS Surveys	A collection of strategic environmental baseline data, including DAS surveys across a Northern Isles study area (results due for imminent publication)	https://naturalengland.blog.gov.uk/2023/02/01/poseidon-offshore-wind-and-nature/	Natural England
Publicly Available Datasets			

Title	Summary	Source	Author and year
Designated Sites	Dataset	NatureScot SiteLink: https://sitelink.nature.scot/home	NatureScot
Seabirds Count national colony census data	Dataset	BTO Seabird Monitoring Programme: https://app.bto.org/seabirds/public/index.jsp	British Trust for Ornithology (BTO)
Seabird tracking database	Dataset	https://www.seabirdtracking.org/ , plus other published tracking data.	Multiple
Literature			
Literature: Potential impacts of offshore windfarms on birds	Peer reviewed scientific literature regarding the potential impacts from OWF	Garthe and Hüppop (2004); Drewitt and Langston (2006); Stienen *et al*. (2007); Speakman *et al*. (2009); Langston (2010); Band (2012); Cook *et al*. (2012); Furness and Wade (2012); Wright *et al*. (2012); Furness *et al*. (2013); Johnston *et al*. (2014a; 2014b); Cook *et al*. (2014; 2018); Dierschke *et al*. (2017); Jarrett *et al*. (2018); Leopold and Verdaat (2018); Mendel *et al*. (2019); Goodale and Milman (2020); APEM (2022).	Multiple
Literature: Bird Distribution	Publicly available reports of seabird distribution	Stone *et al*. (1995); Brown and Grice (2005); Kober *et al*. (2010); Bradbury *et al*. (2014); HiDef Ltd. (2015); Waggitt *et al*. (2019); Cleasby *et al*. (2020); Davies *et al*. (2021).	Multiple

Title	Summary	Source	Author and year
Literature: Bird breeding ecology	Publicly available information on the breeding ecology of various bird species	Cramp and Simmons (1977-94); Del Hoyo *et al*. (1992-2011); Robinson (2005).	Multiple
Literature: Bird Population estimates and demographic rates	Publicly available reports/data on seabird populations and demographic rates for use in assessments	Mitchell *et al*. (2004); BirdLife International (2004); Holling *et al*. (2011); Musgrove *et al*. (2013); Furness (2015); Horswill *et al*. (2017); Frost *et al*. (2019); JNCC (2020).	Multiple
Literature: Bird migration and foraging movements	Publicly available reports of bird movements during breeding season foraging trips and migration	Wernham *et al*. (2002); Thaxter *et al*. (2012); Wright *et al*. (2012); Wakefield *et al*. (2013; 2017); Furness *et al*. (2018); Woodward *et al*. (2019), Woodward *et al*. (2023).	Multiple

11.4 Pre-Scoping Engagement

To date, consultation with regards to offshore ornithology has been primarily via a pre-scoping workshop held in November 2023, though the Developer has also engaged with NatureScot in relation to agreement of baseline survey methods. Attendees of the pre-scoping workshop included:

- MD-LOT;
- MD-SEDD
- NatureScot;
- SIC;
- UHI Shetland;
- SOTEAG;
- RSPB.

The actions listed in Table 11.2 were agreed during the workshop. The Developer has provided the Arven 6-month DAS report to relevant organisations alongside this Scoping Report for their comment. The advice and potential data sources referred to in Table 11.2 will be further pursued to inform EIA.

Table 11.2: Ornithology-relevant outcomes from the Pre-Scoping Workshop 1

Action	Responsibility
NatureScot to provide links to any additional species guidance available on petrel and shearwater species	NatureScot
The Developer to provide 6-month DAS survey report to RSPB and NatureScot	The Developer
UHI Shetland to provide links to relevant seabird datasets	UHI Shetland
MD-SEDD flagged planned tracking studies for non-breeding birds, relevant to Shetland, with further information on these to be provided to the Developer	MD-SEDD
NatureScot to further advise the Developer regarding transboundary impacts and the inclusion of Non Native Species that may forage within study area	NatureScot

11.5 Baseline Environment

11.5.1 Ornithological Overview

The Shetland Islands are an important seabird area, as they contain one tenth of the UK's breeding seabirds, along with important breeding sites for waders and other ground nesting birds (Shetland Islands Council, 2017). The Offshore Proposed Development area also borders important breeding sites for nine nationally important seabird breeding populations (Shetland Islands Council, 2017).

Important Ornithological Features (IOFs) refer to the proposed species for consideration in impact assessment. The initial list of potential IOFs includes species that have been recorded in the site-specific DAS and that are also nationally or internationally important designated features of key designated sites. Seabirds which have breeding season connectivity within the mean-maximum +1 Standard Deviation (SD) foraging ranges (Woodward *et al.*, 2019) are also considered as IOFs due to their potential for interaction with the Offshore Proposed Development[9]. Furthermore, waterbirds from key designated sites that overlap with the Offshore Proposed Development are also considered IOFs due to their vulnerability to displacement effects.

[9] Seabird foraging ranges are quantified with distance units such as Mean-maximum foraging range +1 Standard Deviation (SD). The mean-maximum foraging range for a seabird species describes the maximum distance that seabirds travel from their nesting site to forage for their prey. This maximum is derived from

Finally, the migratory paths of key species from Wright *et al*. (2012) and Woodward *et al* (2023) were analysed to inform the scoping exercise. IOFs include any species whose migratory path includes the area of the Offshore Proposed Development, with there being potential for interaction with the Offshore Proposed Development.

The surveys commissioned by the Developer, as well as the relevant sources identified from the literature (Wright *et al*., 2012; Shucksmith, 2017; Woodward *et al*., 2023) provide a strong indication of the species that will likely be present within the area of the Offshore Proposed Development. However, the list of IOFs included in this Scoping Report may be updated based upon the results of the complete twenty-four months of site-specific DAS and further stakeholder feedback.

averaging the maximum tracked foraging distances that were recorded in academic literature for each species (Woodward *et al*., 2019). The SD was then calculated to account for a wider uncertainty in seabird foraging ranges. The inclusion of sites within the mean-maximum +SD distance to the Offshore Proposed Development demonstrates a precautionary approach that seeks to consider any species with potential connectivity.

Table 11.3: Mean densities (birds per km²) and abundances of all birds recorded for most numerous species from DAS within the Array Areas plus 6 km buffer, April 2023 to September 2023. Values in bold are monthly peak estimates.

	April		May		June		July		August		September	
Species	Mean density[10]	Mean abundance[11]	Mean density	Mean abundance	Mean density	Mean abundance	Mean density	Mean abundance	Mean density	Mean abundance	Mean density	Mean abundance
Kittiwake	0.11	143	0.05	66	0.04	48	0.01	8	0.01	17	0.02	25
Guillemot	1.86	2,482	0.36	475	0.78	1,039	0.15	202	0.06	82	0.09	118
Puffin	0.18	240	0.13	171	0.3	398	0.08	112	0.02	32	0.02	25
Fulmar	0.75	1,001	1.61	2,144	0.96	1,280	1.36	1,812	0.75	997	6.22	8,296
Gannet	0.39	521	0.38	510	0.48	642	0.32	423	0.72	959	1.26	1,679

[10] The mean estimated number of individuals per unit area (in this case km²) of habitat during the period of time that the survey took place.
[11] The mean estimated number of individuals in a specified area during the period of time that the survey took place.

Table 11.4: Other species raw counts of all birds recorded from DAS within the Array Areas plus 6 km buffer, April 2023 to September 2023

Species	April	May	June	July	August	September
Arctic tern	0	0	4	2	0	0
Common tern	0	0	1	0	1	0
Common/Arctic tern	0	0	3	0	0	1
Great skua	0	0	1	3	1	2
Herring gull	0	0	0	1	0	2
Razorbill	12	0	12	2	0	1
Storm petrel	0	0	7	2	0	21

11.5.2 Species Identified as IOFs

Based on the data sources described above, the key species that can be identified as IOFs relevant to the Offshore Proposed Development area are described below.

Species are included based on an evaluation of their abundance, sensitivity to wind farm impacts, and conservation value. A summary chart of likely IOF species and their conservation value is outlined in Table 11.5.

No species are to be scoped out of EIA at this stage. The list of features to be assessed will be reviewed once the full twenty-four months of DAS data have been processed.

- Arctic Skua (*Stercorarius parasiticus*)
    - Arctic skua were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), although only one has been recorded in the six months of DAS data collected so far. Shetland is considered to be the breeding stronghold for this species, supporting approximately 70% of all breeding Arctic skuas in the UK (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with declines of 74% in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). Their migratory zone crosses the area of the Offshore Proposed Development, and they have a moderate risk of collision and a very low risk of displacement (Wright *et al*., 2012; Furness *et al*., 2013; Bradbury *et al*., 2014; Dierschke et al., 2016). That said, there is considerable uncertainty around these ratings, as the at-sea behaviour of this species, and particularly its response to OWFs, is relatively poorly understood relative to some other seabird species. Therefore, Arctic skua are included as an IOF due to their potential presence within the area of the Offshore Proposed Development and risk of collision. The species will be reassessed as an IOF dependent on the outcomes of the full two years of DAS data.
- Black-headed Gull (*Chroicocephalus ridibundus*)
    - Black-headed gull have a potential migration zone that overlaps with the area of the Offshore Proposed Development (Wright *et al*., 2012), although none have been recorded in the six months of DAS data collected so far. They have a high risk of collision and a low risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). Therefore, black-headed gull are proposed to be included as an IOF due to their potential presence within the area of the

Offshore Proposed Development and high risk of collision. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.

- Common Tern (*Sterna hirundo*)
    - Common tern were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). The six months of DAS data received so far only recorded two common terns in the survey area. They have a moderate risk of collision and a low risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). Furthermore, their migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, common tern are included as an IOF due to their presence within the area of the Offshore Proposed Development and risk of collision.
- Fulmar (*Fulmarus glacialis*)
    - Fulmar were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). Fulmar is the most abundant species recorded from the six months DAS data received so far with a total of 1,947 birds recorded with a peak of 1,048 birds in September. Shetland is considered to be the breeding stronghold for this species, supporting approximately 151,000 pairs (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UK wide declines of 37% (decline of 20% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This peak represents a mean density of 6.22 birds and a mean abundance estimate of 8,296 birds for September (Table 11.3). This species is categorised as having a very low risk for collision and displacement (Furness *et al*., 2013; Bradbury *et al*., 2014), though there is some uncertainty around the true impacts on this species due to a general lack of data (Deakin *et al*, 2022). The Offshore Proposed Development overlaps with the man-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding fulmar populations from Noss SPA, Fetlar SPA, Hermaness, Saxa Vord and Valla Field SPA, Foula SPA and Fair Isle SPA. Fulmar are included as an IOF due to their high presence in the area of the Offshore Proposed Development.
- Gannet (*Morus bassanus*)
    - Gannet were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). From the six months of DAS data received a total of 591 gannets were recorded with a peak count of 212 in September. September's peak mean density and abundance for gannet were 1.26 and 1,679 birds respectively (Table 11.3). Shetland is home to approximately 20% of the Scottish population of gannet (Burnell *et al.,* 2023). The trend in numbers of breeding birds is positive, with UK wide increases of 40% (93% increase in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). However, these increases will be reduced significantly due to the impacts of HPAI. This species is categorised as having a high risk for collision and likely to be assessed adjusting densities in the CRM for macro-avoidance (Furness *et al*., 2013; Bradbury *et al*., 2014). The 2019 Beatrice OWF presented new evidence of windfarm avoidance, as none were seen within the Array Areas of this OWF. Any updated NatureScot guidance based on Pavat *et al* (2023) will be followed. The Offshore Proposed Development overlaps with the mean-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding gannet populations from Noss SPA, Hermaness, Saxa Vord and Valla Field SPA, and Fair Isle SPA. The southerly migration path of certain breeding gannet colonies in Shetland may also cross the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, gannet are included as an IOF due to their presence in the area of the Offshore Proposed Development and risk of collision. They are also included as an IOF on a precautionary basis due to new evidence of their risk of displacement.

- Great Black-backed Gull (*Larus marinus*)
    - Great black-backed gull were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), although only two have been recorded in the six months of DAS data received. Shetland has a breeding population of 1,201 pairs of great black-backed gull (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UK wide declines of 63% (decline of 58% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This species has a very high risk of collision and low risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). It is well known that large gull species (great black-backed, lesser black-backed and herring gull) are attracted to OWFs and spend a comparatively high percentage of the time flying at blade height than other seabird species. Furthermore, their potential migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, great black-backed gull are proposed to be included as an IOF due to their potential presence in the area of the Offshore Proposed Development and risk of collision. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.
- Great Northern Diver (*Gavia immer*)
    - Great Northern Diver were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), although none have been recorded in the six months of DAS data received so far. This species has a moderate risk of collision and a high risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). The population of great northern diver at the East Mainland Coast, Shetland SPA are at risk of disturbance during the construction phase because the OfECC overlaps with this SPA for which they are a designated feature. Therefore, great northern diver are included as an IOF due to their potential presence within the area of the Offshore Proposed Development and risk of displacement. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.
- Great Skua (*Stercorarius skua*)
    - Great skua were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), with a total of seven birds recorded during the six months of DAS. Shetland is considered to be the breeding stronghold for this species, supporting approximately 70% of all breeding great skuas in the UK (Burnell *et al.,* 2023). The trend in numbers of breeding birds is positive, with increase of 14% in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). However, these increases will be reduced significantly due to the impacts of HPAI. They have a moderate risk of collision and a very low risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). That said, there is considerable uncertainty around these ratings, as the at-sea behaviour of this species, and particularly its response to OWFs, is relatively poorly understood relative to some other seabird species. The Offshore Proposed Development overlaps with the mean-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding great skua populations from Noss SPA, Fetlar SPA, Foula SPA and Fair Isle SPA. Furthermore, their migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, great skua are included as an IOF due to their presence in the area of the Offshore Proposed Development and risk of collision.
- Guillemot (*Uria aalge*)
    - Guillemot were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). Guillemot is the third most abundant species recorded in the six months of DAS with a peak count of 305 individuals in April. Mean densities range from 0.08 birds in August to 2.43 birds in April with mean abundances ranging from 3,242 birds in April to 105 birds in August.

Shetland is home to 6.2% of all breeding guillemot in the UK (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UKL wide declines of 11% (declines of 55% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This species has a very low risk of collision and a moderate risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). The Offshore Proposed Development overlaps with the man-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding guillemot populations from Noss SPA, Sumburgh Head SPA, Hermaness, Saxa Vord and Valla Field SPA, Foula SPA, Fair Isle SPA, and Seas off Foula SPA. Furthermore, their migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, guillemot are included as an IOF due to their presence within the area of the Offshore Proposed Development and risk of displacement.

- Herring Gull (*Larus argentatus*)
    - Herring gull were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). Only three herring gulls were recorded during the six months of DAS data received so far. Shetland supports approximately 3% of the UK herring gull breeding population (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UK wide declines of 44% (declines of 53% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This species has a very high risk of collision and a very low risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). It is well known that large gull species (great black-backed, lesser black-backed and herring gull) are attracted to OWFs and spend a comparatively high percentage of the time flying at blade height than other seabird species. Furthermore, their potential migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, herring gull are included as an IOF due to their potential presence within the area of the Offshore Proposed Development and risk of collision.
- Kittiwake (*Rissa tridactyla*)
    - Kittiwake were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). A total of 38 kittiwakes have been recorded in the first six months of DAS with a peak count of 18 in April. Peak mean densities and abundances are 0.11 birds and 143 birds respectively (Table 11.3). Shetland supports 1.6% in the UK population of kittiwake (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UK wide declines of 57% (declines of 80% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This species has a high risk for collision and a very low risk for displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). The Offshore Proposed Development overlaps with the mean-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding kittiwake populations from Noss SPA, Sumburgh Head SPA, Hermaness, Saxa Vord and Valla Field SPA, Fair Isle SPA, and Foula SPA. Furthermore, their potential migration zone overlaps with the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, kittiwake are included as an IOF due to their presence in the area of the Offshore Proposed Development and risk of collision.
- Lesser Black-backed Gull (*Larus fuscus*)
    - Lesser black-backed gull were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), although only one bird has been recorded in the six months of DAS data received so far. Shetland supports only 95 pairs of the UK population of 55,304 pairs of lesser black-backed gulls (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UK wide declines of 48% (declines of 76% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). They have a very high risk of collision and a very low risk of displacement (Furness *et al*., 2013; Bradbury *et al*.,

2014). It is well known that large gull species (great black-backed, lesser black-backed and herring gull) are attracted to OWFs and spend a comparatively high percentage of the time flying at blade height than other seabird species. Furthermore, their potential migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, lesser black-backed gull are proposed to be included as an IOF due to their potential presence within the Offshore Proposed Development and very high risk of collision. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.

- Puffin (*Fratercula arctica*)
    - Puffin were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). A total of 95 puffins were recorded during the six months of DAS with a peak count of 38 in June. Mean densities ranged from 0.02 in September and 0.30 in June and mean abundances ranged from 25 birds to 398 birds (Table 11.3). Shetland supports 13.5% in the UK population of puffin (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UK wide declines of 32% (declines of 63% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This species has been categorised as having a very low risk for collision and a low risk for displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). The Offshore Proposed Development overlaps with the mean-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding puffin populations from Noss SPA, Hermaness, Saxa Vord and Valla Field SPA, Seas off Foula SPA, Foula SPA, and Fair Isle SPA . Furthermore, their potential migration zone crosses the area for the Offshore Proposed Development (Wright *et al*., 2012). Therefore, puffins are included as an IOF due to their presence within the area of the Offshore Proposed Development.
- Razorbill (*Alca torda*)
    - Razorbill were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). Twenty-seven individuals were recorded during the first six months of DAS with a peak count of 12 in April and June. Shetland supports 1.8% in the UK population of razorbill (Burnell *et al.,* 2023). The trend in numbers of breeding birds is negative, with UK wide declines of 2% (declines of 66% in Shetland) in the numbers of apparently occupied territories between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This species has been categorised as having a very low risk for collision and a moderate risk for displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). The Offshore Proposed Development overlaps with the mean-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding razorbill populations from Foula SPA and Fair Isle SPA. Furthermore, their migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, razorbill are included as an IOF due to their presence within the area of the Offshore Proposed Development and risk for displacement.
- Red-breasted Merganser (*Mergus serrator*)
    - Red-breasted merganser were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). They have a low risk of collision and moderate risk of displacement (Bradbury *et al*., 2014). Furthermore, their potential migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, red-breasted merganser are included as an IOF due to their potential presence within the area of the Offshore Proposed Development and moderate risk of displacement. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.
- Red-throated Diver (*Gavia stellata*)
    - Red-throated diver were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), although none have been recorded in the six months of DAS data received so far. This

species has a moderate risk of collision and a high risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). The breeding population of red-throated diver at the East Mainland Coast, Shetland SPA are at risk of disturbance because the cable corridor for the Offshore Proposed Development overlaps with this SPA for which they are a designated feature. Furthermore, the breeding population of red-throated diver at the East Mainland Coast, Shetland SPA, the Bluemull and Colgrave Sounds SPA, and Otterwick and Graveland SPA are at risk of disturbance because the cable corridor for the Offshore Proposed Development lies within the 9 km foraging range from these breeding colonies (Woodward *et al*, 2019). Key migration zones for red-throated divers also cross the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, red-throated diver are included as an IOF due to their potential presence in the area of the Offshore Proposed Development, high displacement risk, and potential direct overlap with the cable corridor. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.

- Shag (*Phalacrocorax aristotelis*)
    - Shag were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), although none have been recorded in the six months of DAS data received so far. This species has a moderate risk of both collision and displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). Their migratory zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, shag are included as an IOF due to their potential presence within the area for the Offshore Proposed Development and collision and displacement risk. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.
- Slavonian Grebe (*Podiceps auratus*)
    - Slavonian grebe were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017), although none have been recorded in the six months of DAS data received so far. This species has a low risk of collision and a moderate risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). The population of Slavonian grebe at the East Mainland Coast, Shetland SPA is at risk of disturbance because the cable corridor for the Offshore Proposed Development overlaps with this SPA for which they are a designated feature. Their potential migration zone also crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Slavonian grebe are included as an IOF due to their potential presence within the area of the Offshore Proposed Development and displacement risk. The species will be reassessed as an IOF dependent on the outcomes of the two years of DAS data.
- European storm petrel (*Hydrobates pelagicus*)
    - Strom petrels were recorded in the Shetland Islands baseline survey area (Shucksmith, 2017). Thirty individuals were recorded during the first six months of DAS with a peak count of 21 in September. Shetland supports over 11% in the UK population of storm petrel (Burnell *et al.,* 2023). The trend in numbers of breeding birds is positive, with increases of 106% in the numbers of apparently occupied territories in Shetland between 2000 and 2015 to 2021 (Burnell *et al.,* 2023). This species has a low risk of collision and very low risk of displacement (Furness *et al*., 2013; Bradbury *et al*., 2014). That said, there is considerable uncertainty around these ratings, as the at-sea behaviour of this species, and particularly its response to OWFs, is relatively poorly understood relative to some other seabird species. The Offshore Proposed Development overlaps with the mean-maximum +1 SD foraging range (Woodward *et al*., 2019) of the breeding storm petrel populations from Mousa SPA. Furthermore, their migration zone crosses the area of the Offshore Proposed Development (Wright *et al*., 2012). Therefore, storm petrel are included as an IOF due to their presence within the area of the Offshore Proposed Development and risk for collision risk and displacement.

- The region around the Offshore Proposed Development is considered a key area for storm petrel. This species will be analysed using the updated 2022 guidance concerning their population abundance, demographic rates, at-sea distribution and behaviour, and vulnerability to collision and displacement from OWFs (Baker *et al*., 2022; Deakin *et al*., 2022).

Table 11.5: Current IOFs for the Offshore Proposed Development and their Conservation Value (RSPB, n.d.; EU, 2009; Pearce-Higgins, 2021; IUCN, 2023).

Species	Nature Conservation Value
Arctic Skua	Birds of Conservation Concern (BoCC) red listed; IUCN red list 'Endangered' status; 'High risk' breeding population vulnerability to climate change
Black-headed Gull	BoCC amber listed; IUCN red list 'least concern' status; 'High benefit' breeding population vulnerability to climate change
Common Tern	BoCC amber listed; Birds Directive Annex I; IUCN red list 'least concern' status; 'High benefit' breeding population vulnerability to climate change
Fulmar	BoCC amber listed; IUCN red list 'least concern' status; 'High benefit' breeding population vulnerability to climate change
Gannet	BoCC amber listed; IUCN red list 'least concern' status; 'Limited impact' breeding population vulnerability to climate change
Great Black-backed Gull	BoCC amber listed; IUCN red list 'least concern' status; 'High risk' breeding population vulnerability to climate change
Great Northern Diver	BoCC amber listed; Birds Directive Annex I; IUCN red list 'least concern' status
Great Skua	BoCC amber listed; IUCN red list 'least concern' status
Guillemot	BoCC amber listed; IUCN red list 'least concern' status; 'Medium risk' breeding population vulnerability to climate change
Herring Gull	BoCC red listed; IUCN red list 'near threatened' status; 'High risk' breeding population vulnerability to climate change
Kittiwake	BoCC red listed; IUCN red list 'vulnerable' status
Lesser Black-backed Gull	BoCC amber listed; IUCN red list 'least concern' status; 'High benefit breeding population vulnerability to climate change

Species	Nature Conservation Value
Puffin	BoCC red listed; IUCN red list 'vulnerable' status; 'High risk' breeding population vulnerability to climate change
Razorbill	BoCC amber listed; IUCN red list 'near threatened' status; 'Medium risk' breeding population vulnerability to climate change
Red-breasted Merganser	BoCC amber listed; IUCN red list 'Near Threatened' status; 'Medium risk' breeding population vulnerability and 'medium benefit' winter population vulnerability to climate change
Red-throated Diver	BoCC green listed; Birds Directive Annex I; IUCN red list 'least concern' status; 'High risk' breeding population vulnerability to climate change
Shag	BoCC red listed; IUCN red list 'least concern' status; 'Medium risk' breeding population vulnerability to climate change
Slavonian Grebe	BoCC red listed; Birds Directive Annex I; IUCN red list 'critically endangered' status; 'High benefit' winter population vulnerability to climate change
European Storm Petrel	BoCC amber listed; Birds Directive Annex I; IUCN red list 'least conceern' status; 'High risk' breeding population vulnerability to climate change

Once site-specific IOFs have been confirmed, the EIA analysis will consider how IOFs use the Offshore Proposed Development site according to season and life stage. Table 11.7 provides an overview of the breeding and non-breeding seasons for each potential IOF. Relevant seasons help evaluators understand the behaviour of each species, as their interaction with the Offshore Proposed Development will change over the year. Reference populations for this analysis will be based on the best available information at the time of the assessment.

The migratory waterfowl and waders presented in Table 11.6 were assessed for IOFs based on the Offshore Proposed Development HRA Screening Report and the Woodward (2023) report outlining migration routes, selecting species where the migration route intersects the Array Areas.

Table 11.6 Migratory species identified as potential IOFs based on Woodward (2023)

Migratory Species		
Barnacle Goose	Greylag goose	Pink-footed goose
Whooper swan	Shelduck	Shoveler

Gadwall	Wigeon	Mallard
Pintail	Teal	Pochard
Tufted duck	Scaup	Eider
Velvet scoter	Common scoter	Long-tailed duck
Goldeneye	Goosander	Red-breasted merganser
Oystercatcher	Lapwing	Golden plover
Grey plover	Curlew	Bar-tailed godwit
Black-tailed godwit	Turnstone	Knot
Ruff	Sanderling	Dunlin
Purple sandpiper	Snipe	Redshank
Greenshank		

Table 11.7: Species-specific defined seasons (NatureScot, 2020).

Species	Breeding	Non-Breeding
Arctic Skua	May - August	September - April
Black-headed Gull	April - August	September - March
Common Tern	May - Mid-September	Mid-September - April
Fulmar	April – Mid-September	Mid- September - March
Gannet	Mid-March - September	October – Mid-March
Great Black-backed Gull	April - August	September March
Great Skua	Mid-April – Mid-September	Mid-September – Mid-April
Guillemot	April – Mid-August	Mid-August - March
Herring Gull	April - August	September - March
Kittiwake	Mid-April - August	September – Mid-April
Lesser Black-backed Gull	Mid-March - August	September – Mid-March
Puffin	April – Mid-August	Mid-August - March
Razorbill	April – Mid-August	Mid-August - March
Red-breasted Merganser	Mid-April – Mid-August	Mid-August – Mid-April
Red-throated Diver	May – Mid-September	Mid-September - April
Shag	March - September	October - February
European Storm Petrel	Mid-May – October	November – Mid-May
Great Northern Diver	N/A[12]	N/A
Slavonian Grebe	N/A[13]	N/A

11.5.3 Designated Sites

Seabirds and migratory bird species may travel long distances during both the breeding and non-breeding seasons. As such, there is the potential for sites which are designated for ornithological features to have connectivity with the Offshore Proposed Development.

The Array Areas of the Offshore Proposed Development do not directly overlap with any ornithological designations. However, the OfECC, when defined, is likely to have direct overlap with the East Mainland Coast,

[12] No defined seasons published for great northern diver
[13] No defined seasons published for Slavonian grebe

Shetland SPA. Furthermore, bird species from other nearby designated sites (including seabirds, waterfowl and waders) may travel to or through the Offshore Proposed Development for foraging, commuting, or migration.

Relevant ornithological designated sites were determined based on the connectivity of their designated features with the Offshore Proposed Development. These features included seabirds who have breeding season connectivity within the mean-maximum +1 SD foraging ranges (MMFR) (Woodward *et al*., 2019) and breeding divers within 10 km of the Offshore Proposed Development. The key designated sites[14] with possible connectivity are listed below (note that a separate review of European sites has been undertaken and is presented separately in the HRA Screening Report:

- Noss SPA;
- East Mainland Coast, Shetland SPA;
- Fetlar SPA;
- Bluemull and Colgrave Sounds SPA;
- Otterswick and Graveland SPA;
- Sumburgh Head SPA;
- Hermaness, Saxa Vord, and Valla Field SPA;
- Ronas Hill – North Roe and Tingon Ramsar;
- Seas off Foula SPA;
- Foula SPA; and
- Fair Isle SPA.

11.5.4 Highly Pathogenic Avian Influenza Virus (HPAI)

HPAI has had widespread effects within seabird populations across the UK and western Europe since 2021 with 9,610 dead and sick wild birds reported across Scotland in 2023 (NatureScot, 2023). The RSPB produced a report this year (Tremlett *et al*, 2024) highlighting the impacts of the HPAI outbreak on UK seabird colonies following surveys in 2023. Table 11.8 highlights some of the findings from the report in regards to relevant Shetland SPAs and high priority species. Reference populations for assessing effects on each species population sizes will be based on the best and most recent available information to consider the impacts of HPAI and any guidance issued by SNCBs relating to HPAI will be considered.

[14] Not all sites within the MMFR are included and they will be reviewed in more detail in the HRA screening. These sites were excluded due to the vast range of certain species MMFR and the likelihood of impact from the Offshore Proposed Development being minimal.

Table 11.8: Percentage change in SPA colony numbers after the HPAI outbreak on high priority species

Species	Foula SPA	Fair Isle SPA	Noss SPA	Hermaness, Saxa Vord and Valla Field SPA	Other
Gannet	-	- 3%	- 10%	- 37%	-
Great skua	- 83%	-	- 86%	- 77%	- 69% (Fetlar)
Kittiwake	-	-	+12%	-21%	-83% (Sumburgh Head)
Arctic skua	-	+55%	-	-	+21% (Mousa)
Guillemot	-	-	- 17%	+10%	-

11.6 Embedded Mitigation

The potential for embedded mitigation to reduce the potential effects on IOFs will be considered throughout the Project design process. These measures may be identified and evolve in response to the results of site-specific surveys and impact modelling, stakeholder consultation, and the progression of the EIA.

As part of the initial design process, embedded mitigation measures have been proposed to reduce the potential environmental effects of the Offshore Proposed Development. Measures relevant to offshore ornithology are as follows:

- C-8: Appointment of an Environmental Clerk of Works (ECoW). The ECoW will monitor compliance of the Project with granted consents.
- C-12: Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction Project phases.
- C-13: Development of and adherence to a VMP. The VMP will confirm the types and numbers of vessels that will be engaged on the Project and consider vessel coordination including indicative transit route planning.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.
- C-15: Development of and adherence to a Construction Programme (CoP). The CoP will confirm the timing and duration of the main Project construction activities.
- C-16: Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.
- C-43: There will be a minimum blade tip clearance (air draft height) of at least 22 m above MHWS.

11.7 Scoping of Impacts

This study has identified the key offshore ornithology receptors that are most vulnerable to any potential impacts of the Offshore Proposed Development. This section will highlight any potential impact pathways that

can affect the IOFs. These impacts may occur during the construction, O&M, and decommissioning phases of the Project. Scoping these impacts at this stage of the Project development will form a strong baseline as the project moves forward into the next stages of the consenting process. The potential impacts of the Offshore Proposed Development are outlined in Table 11.9 and Table 11.10.

11.7.1 Potential Impacts scoped in

Table 11.9 defines those potential impacts that are proposed to be scoped into EIA.

Table 11.9: Impacts scoped into the assessment of Offshore Ornithology

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction and Decommissioning			
Direct temporary habitat loss/disturbance	Construction of the Offshore Proposed Development will result in increased vessel activity, airborne noise and underwater noise. This disturbance may displace IOFs from important feeding and roosting areas, especially if habitat is directly lost during construction. These impacts may occur across both the OfECC and Array Areas and a buffer around them, as well as when vessels are transiting.	Displacement Analysis; (Sections 11.10.3.4). A quantified assessment based on the area of seabed disturbed and the impact from vessels on birds during construction. The assessment of disturbance and species sensitivities will be based on existing literature (Furness *et al*., 2013; Bradbury *et al*., 2014, Wade *et al*., 2016).	C-12 (PEMP); C-13 (C-14 (DP) ; C-15 (CoP); C-16 (LMP)
Indirect impacts due to impacts on prey species during construction	Construction impacts, including underwater noise from piling and the generation of suspended sediments, may alter the distribution, physiology, or behaviour of bird prey species. This may reduce the amount of prey available around the construction works, indirectly impacting IOFs.	Qualitative Analysis; Underwater noise modelling for the Offshore Proposed Development will be used to determine potential impacts on prey species from construction noise. Results from the Fish and Shellfish assessment will be used to establish the potential effects on birds. A qualitative assessment will be undertaken using the predicted extent of the impact and relevant	C-12 (PEMP); C-15 (CoP)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
		literature in regards to fish behaviour towards noise.	
Impacts resulting from artificial light	Impacts resulting from artificial light are expected to be minimal; however, there is some evidence that European storm petrel can be impacted by artificial light. They were recorded in the site-specific DAS for the Offshore Proposed Development.	Qualitative Analysis; A qualitative assessment undertaken based on the latest published literature on the impacts artificial lighting has on seabirds.	C-8 (ECoW); C-12 (PEMP); C-16 (LMP)
Indirect effects due to UXO clearance	UXO clearance has the potential to cause physical injury and death to diving offshore ornithology receptors below water at time of UXO detonation. The reduction or disruption of prey availability due to detonations may cause reduced energy intake affecting productivity or survival of offshore ornithology receptors.	Qualitative Analysis; Underwater noise modelling for the Project will be used to determine potential impacts on prey species and a qualitative assessment undertaken based on predicted area of impact and the known behaviour of fish from noise using the latest published literature.	C-8 (ECoW)
Operation and Maintenance			
Disturbance and displacement (from physical presence of WTG and maintenance vessels)	Activities associated with the maintenance of the WTGs (and other associated structures) and OfECC will result in the presence of vessels. This may disturb and displace bird species within the OfECC and Array Area. However, this impact is likely to be both spatially and temporally restricted, with maintenance within the OfECC and Array Area during the O&M phase being	Displacement Analysis; Population Viability Analysis (Sections 11.10.3.4 & 11.10.3.5). Both displacement modelling and PVA will be undertaken to quantify the level of impact from displacement.	C-12 (PEMP)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	sporadic, temporary and only undertaken on restricted areas of the OfECC and Array Area.		
Distributional responses	It is not usually possible to distinguish between displacement and barrier effects for resident birds. It is not usually possible to define where individual birds intend to travel to in and beyond an OWF, even when tracking data are available. Both sitting and flying birds will be included within the displacement analysis. The inclusion of sitting birds within the analysis accounts for those individuals who are potentially displaced from an area of sea in which they reside. The inclusion of flying birds accounts for any potential barrier effects. Therefore, the impact assessment will consider the effects of displacement and barrier effects on IOFs together. The impacts on barrier effects alone will not be considered as a separate impact.	Displacement Analysis; Population Viability Analysis (Sections 11.10.3.4 & 11.10.3.5). Barrier effects will be assessed alongside disturbance and displacement, using the recommended SNCB matrix approach and PVA.	C-12 (PEMP)
Collision risk	There is a risk of birds in flight colliding with rotating WTG blades. The risk that collision poses to individual IOFs is species-dependent based on their morphological and behavioural characteristics.	Collision Risk Assessment; Migratory Birds Report; Population Viability Analysis (Sections 11.10.3.2, 11.10.3.3 & 11.10.3.5). Collision risk modelling and PVA will be undertaken to quantify the estimated level of impact.	C-12 (PEMP); C-43 (Minimum blade clearance)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Entanglement	Whilst little is currently known about it, the potential exists for entanglement of diving seabirds with floating foundations during the operation and maintenance period.	Qualitative Analysis; A qualitative assessment undertaken based on the latest published literature on the impacts of entanglement has on seabirds.	C-12 (PEMP)
Indirect impacts due to impacts on prey species	The presence of turbines may alter the distribution, physiology, or behaviour of bird prey species. These effects could potentially result in less prey being available in the Array Areas and surrounding buffer, impacting foraging seabirds.	Qualitative Analysis; Noise modelling for the Project will be used to determine potential impacts on prey species from construction noise. Results from the Fish and Shellfish chapter (Chapter 9) will be used to establish the potential effects on birds. A qualitative assessment will be undertaken using the predicted extent of the impact and relevant literature in regards to fish behaviour towards noise.	C-12 (PEMP)
Impacts from artificial light	Impacts resulting from artificial light are expected to be minimal; however, there is some evidence European storm petrel can be impacted by artificial light. They were recorded in the site-specific DAS for the Offshore Proposed Development.	Qualitative Analysis; A qualitative assessment undertaken based on the latest published literature on the impacts artificial lighting has on seabirds.	C-12 (PEMP); C-16 (LMP)

11.7.2 Potential Impacts scoped out

Table 11.10 identifies those impacts that are proposed to be scoped out of EIA.

Table 11.10: Impacts proposed to be scoped out of further assessment for Offshore Ornithology

Impact	Justification
Construction and Decommissioning	
Impacts resulting from accidental pollution during construction	Accidental pollution during the construction and decommissioning of the Offshore Proposed Development may result from spills or contaminant release. These potential impacts can result in the direct mortality of IOFs or the reduction of prey availability. Any potential pollution events are predicted to be of local spatial extent, short term duration, and insignificant in EIA terms. A major incident that may impact any species at a population level is considered extremely unlikely. During consenting of other OWFs, it has been agreed with stakeholders that with the implementation of an appropriate EMP (C-6) and MPCP (C-9), direct mortality is very unlikely to occur. This is considered equally applicable for this Offshore Proposed Development, where an EMP and MPCP will be in place that clearly set out actions to be taken in the event of any spill event. It is therefore proposed that this impact pathway is scoped out from further consideration within the EIA.
Barrier effect for migration species	The small energetic cost of migrating birds flying around rather than through the Array Areas is considered a potential barrier effect. Masden *et al*. (2010; 2012) and Speakman *et al.* (2009) calculated that the costs of one-off avoidances during migration were small, accounting for less than 2% of available fat reserves. The inclusion of flying birds in the displacement assessment accounts for any potential barrier effects. Therefore, a separate assessment for the effects of barrier effects on IOFs is not necessary and has scoped out.

11.8 Potential Cumulative Impacts

There is potential for the predicted impacts of the Offshore Proposed Development, along with the predicted impacts of other operational, consented, and planned OWFs, to create cumulative impacts for IOFs. Many bird species are highly mobile, and there is potential for certain species to be affected by several wind farms. Existing operational OWFs in the North Sea and proposed ScotWind and INTOG projects are of particular relevance to the cumulative assessment.

The process by which potential cumulative impacts will be assessed through the CIA is described in Chapter 4: EIA Methodology. The Offshore Ornithology CIA for the Offshore Proposed development will consider the

maximum design scenario for post consent projects or post submission projects and any associated activities on the species being assessed (Chapter 4: EIA Methodology). The CIA will consider the findings of post-construction studies which are being undertaken (e.g. for Beatrice, Moray East and Kincardine OWFs).

The Sectoral Marine Plan identified distributional responses and collision risk as key concerns for ornithological receptors at the in-combination level (Scottish Government, 2020). Both impacts are expected to be highest during the operation and maintenance phase of the Offshore Proposed Development. During the construction and decommissioning phases, impacts from distributional responses will be scoped out, as the likelihood of a cumulative impact is small. The current ScotWind and INTOG consenting rounds have seen a wide spatial and temporal distribution of projects, so significant additive effects from simultaneous construction phases are unlikely.

The CIA will consider the use of the Cumulative Effects Framework (CEF). The CEF is currently being developed for Marine Directorate (UK Centre for Ecology & Hydrology, n.d.), and should it be available, functioning properly, and fully tested, the Project will consider utilizing it. This decision would be made in conjunction with key stakeholders.

11.9 Potential Transboundary Impacts

In addition to cumulative impacts from UK OWFs, there is potential for international seabird populations to be impacted by the Offshore Proposed Development. The process by which potential transboundary impacts will be assessed is described in Chapter 4: EIA Methodology.

Due to the location of the Offshore Proposed Development and the potential ornithological receptors, the assessment will consider the impacts on transboundary sites. In the non-breeding season where birds may have a larger range, it is possible that birds from non-UK seabird colonies may also occur within the Offshore Proposed Development study area. Therefore, there may be impacts on birds originating from non-UK colonies, but these potential migratory impacts will be assessed separately in the migratory CRM (mCRM).

Transboundary impacts are incorporated into the assessment by using regional and biogeographic populations that include overseas colonies where appropriate. It is predicted there will be no breeding season connectivity to transboundary sites for all species.

11.10 Proposed Approach to EIA

11.10.1 Relevant Guidance

Impact assessments will be undertaken in line with current statutory nature conservation body (SNCB) guidance, especially NatureScot (2023), CIEEM EIA guidance (2018; updated 2023), and expert opinion.

11.10.2 Anticipated Additional Data Sources at EIA

The ongoing site-specific DAS data will form the main body of the EIA assessment. The DAS will cover the period from April 2023 to March 2025, covering the Array Areas plus a 6 km buffer. Flight transects are being spaced out at 2 km intervals with a coverage of approximately 12.5% and are being conducted at a flight height of 500-550 m. The images are captured at a 2 cm ground survey distance (GSD) resolution, allowing for

possible identification for the large majority of seabirds to species level. Using these methods results in no or minimal disturbance to the seabirds using the survey area.

The DAS data will provide site-specific information on the present species or species groups where identification to species level is not possible. Species information will include abundance, distribution, behaviour, location, numbers, sex and age where possible, flight height, and flight direction. The EIA will identify the differences in site use based on seasonality and life stage of each species.

Abundance and density estimates (with associated confidence intervals and levels of precision) will be estimated from this data using a design-based modelling approach, with model-based abundances provided where possible. The species for which model-based abundance estimates will be confirmed when the full 24-months of DAS data is available.

Flight height estimation methods and data will be reported; however, owing to the technical difficulties in estimating flight height from aerial imagery, it is anticipated that generic flight data (Johnston *et al*., 2014a; Johnston *et al*., 2014b) will be used in the collision risk model (subject to discussion with stakeholders).

The Developer conducted seabird colony counts during the breeding season in 2023 at Noss SPA and Hermaness, Saxa Vord and Valla Field SPA and will continue with more colony counts in Shetland in 2024. The data collected will be used during the assessment as the most up to date colony data for the sites.

Other survey information or data from existing OWFs may be drawn upon to inform the EIAR. This information will be clearly defined within relevant documents, if used.

The EIA will also consider the most relevant and up-to-date evidence that enters the public domain. This includes (but is not limited to) results from past, present, and ongoing research projects from ScotMer (n.d.), the Offshore Wind Strategic Monitoring and Research Forum (OWSMRF; JNCC, n.d.), and the Offshore Renewables Joint Industry Programme (ORJIP; ORJIP, n.d.).

The Developer has been exploring opportunities to undertake or support seabird tagging and tracking studies to inform baseline characterisation. To date, limited opportunities have been identified, reflecting several factors including the logistical difficulty of accessing relevant Shetland colonies and concerns around the implications of tagging in light of HPAI effects.

The requirement for and scope of any ornithological survey and data collection required at the preferred landfall location, once identified, will be discussed with NatureScot and presented in the onshore EIA scoping exercise.

11.10.3 Assessment Methodology

The impact assessment methodology will be based on that described in Chapter 4: EIA Methodology and adapted to the needs of analyzing ornithological receptors. The Offshore Ornithology EIA will be supported by a number of technical appendices which will be described in greater detail below. These include:

- Ornithology Baseline Technical Report;
- Collision Risk Assessment;

- Migratory Birds Report;
- Displacement Analysis; and
- Population Viability Analysis.

It should be noted that the current understanding is that several of the tools that will be used in the assessment (e.g. SeabORD) are will only be accessible through the CEF. However, at present there is a lack of certainty around the CEF regarding its usability and availability, making any definitive decisions on the cumulative assessment methodology challenging at scoping stage. The Project will stay abreast of any new information a guidance regarding its use within project alone and cumulative assessments.

The EIA assessment will use a 'source-pathway-receptor' model. This identifies likely impacts on IOFs from the proposed construction, O&M, and decommissioning phases of the Offshore Proposed Development. The EIA assessment will be undertaken using the best available information, following the most recently available NatureScot guidance (NatureScot 2023) with further information on criteria used in each section of the EIA. The parameters of this model are defined below:

- Source – the origin of a potential impact (noting that one source may have several pathways and receptors; for example, an activity such as cable installation and a resultant effect such as resuspension of sediments).
- Pathway – the means by which the effect of the activity could impact an IOF (for instance, for the above example, re-suspended sediment could settle and smother the seabed).
- Receptor – the element of the receiving environment that is impacted (for instance, for the above example, bird prey species living on or in the seabed are unavailable to foraging birds).

For this model, species identified as IOFs, subject to the completion of DAS data collection, will be assessed against the impact pathways presented in Table 11.9.

This process complements the accompanying HRA Screening report which studies the Offshore Proposed Development's connectivity to any relevant European Sites, including sites which form the UK's National Site Network, SPAs, and RAMSAR sites.

The following sections outline the suggested methodology based on current guidance, noting that this may evolve with subsequent stakeholder input.

11.10.3.1 Ornithology Baseline Technical Report

The baseline technical report will characterise the existing environment and potential offshore ornithological receptors in line with NatureScot guidance (NatureScot 2023b). This will be undertaken using a combination of site-specific DAS data and available information from a desk-based study, some of the key sources for which are presented in Table 11.1.

11.10.3.2 Collision Risk Assessment

The collision risk assessment will provide details of the collision risk modelling (CRM) that will predict impacts on relevant IOFs. It is proposed to undertake CRM using the updated 2022 version of the Marine Science Scotland Stochastic Collision Risk Model Shiny Application ("sCRM App") in line with NatureScot guidance (Caneco, 2022; NatureScot, 2023c). This will be run deterministically and stochastically (incorporating standard deviations of input parameters where these are available). Monthly densities of flying birds derived

from DAS data will be used to populate the sCRM. Models will be run using Option 2 (Basic model) using generic flight height distributions from Johnston *et al*. (2014a; 2014b). Option 3 (Extended model; Band, 2012) may also be presented to add further context to the CRM results, if deemed appropriate.

Based on the currently available data from the six month of DAS data, the following species are proposed to be assessed for collision risk (noting that this list may change following the receipt of site-specific DAS data).

- Kittiwake
- Great Black-backed Gull
- Herring Gull
- Lesser Black-backed Gull
- Common Tern
- Arctic Tern
- Great Skua
- Arctic Skua
- Gannet
- Storm Petrel
- Fulmar

11.10.3.3 Migratory Birds Report

A mCRM assessment will also be undertaken, assessing the potential collision risk for migratory non-seabird species using the mCRM shiny app (HiDef, 2023) as recommended by NatureScot and the Marine Directorate (NatureScot, 2023c). This study will use Wright *et al*. (2012) to identify key species whose migration routes overlap with the area of the Offshore Proposed Development. An updated review of migratory routes and vulnerabilities across the UK (Woodward *et al*, 2023) has been prepared on behalf of Marine Directorate and The Crown Estate. This work also includes development of a stochastic mCRM tool to enable quantitative assessment of risks to migratory SPA species, including swans, geese, divers, seaducks, and raptors. This tool is expected to be used for the assessment following NatureScot guidance (NatureScot, 2023c).

11.10.3.4 Distributional Responses Analysis

The distributional responses report will provide details of the displacement assessment undertaken and predicted impacts on relevant IOFs. It is proposed that the Joint SNCB recommended matrix approach (JNCC and SNCB, 2022) is used. This approach presents a range of displacement and mortality rates for each included species, as recommended by NatureScot Guidance (NatureScot 2023a). This guidance recommends the use of the overall mean seasonal peak numbers of birds (averaged over the years of survey) in the development footprint and appropriate buffer for the displacement assessment. The displacement and mortality rates used in the assessment will be based on the best available evidence and consultation with SNCBs. If there are disagreements, two approaches may be presented.

The analysis will consider both sitting and flying birds. As per NatureScot guidance, this assessment accounts for distributional responses of birds and, therefore, impacts resulting from potential barrier effects are also covered within this assessment (NatureScot 2023a).

During the breeding season, it is also expected that the SeabORD displacement assessment tool will be used for species with available tracking data to parameterize the model and the distance-decay mode will be used

where tracking data is not available (Searle *et al*., 2018). However, it is noted that a number of elements may reduce the effectiveness of this tool as highlighted for the Berwick Bank Wind Farm (SSE Renewables, 2022). These elements include the sensitivity of the model to input parameters, the incorporation of accurate uncertainty in output metrics, and the current over-precautionary nature of several model assumptions.

11.10.3.5 Population Viability Analysis

Population Viability Analysis (PVA) will be used to model the effects of the predicted impacts of the Project on key species from relevant breeding colonies. As per NatureScot guidance, PVA will be undertaken when the assessed effect exceeds a change to the adult annual survival rate of 0.02% change (NatureScot, 2023d).

Modelling and assessment of potential impacts will be carried out using the Natural England PVA Tool (Searle *et al*., 2019). All models will be run for two or three time periods (25 years, 50 years, and the intended lease period) as per NatureScot guidance (NatureScot, 2023d).

Density dependent models are expected to be used, as these models are deemed more biologically realistic based on available evidence (Horswill and Robinson, 2017). Both the counterfactual of population size and population growth rate will be considered as the key model outputs.

Initial population sizes used in the PVA assessment will be based on the most up to date population data, likely from the colony counts conducted by the developer at key Shetland SPAs and the SMP database, and productivity values and survival rates will be based on Horswill and Robinson (2015).

11.11 Scoping Questions

The following scoping questions refer to the offshore ornithology chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree that the data sources listed in section 11.3 and 11.5.1 can be used to robustly characterise the Offshore Ornithology baseline within the EIA? If not, what additional sources of data should be used?
- Do you agree with the initial list of IOFs?
- Do you agree with the initial list of key designated sites?
- Do you agree on the suitability of proposed embedded mitigation of relevance to Offshore Ornithology that have been identified for the Project?
- Do you agree with the impacts which have been scoped out of the EIA for Offshore Ornithology?
- Do you agree with the proposed study areas identified for the Offshore Ornithology receptors?
- Do you agree that barrier effects can be Scoped Out as an impact alone, since they are already assessed within the displacement assessment as 'distributional responses' as per NatureScot guidance?
- Do you agree that construction and decommissioning impacts can be scoped out of the cumulative impact assessment?
- Do you agree that transboundary impacts during the breeding season may be scoped out of the Offshore EIA?
- Do you agree transboundary impacts in the non-breeding season will be counted for by assessing against the biogeographic population and regional populations that include overseas colonies?

- Do you agree with the proposed approach to assessment of cumulative effects related to Offshore Ornithology?
- The project considers the 0.02% decrease in survival rate is a very low threshold for PVA. Is there any updated guidance on this and is the same threshold considered appropriate for cumulative impacts?
- Can further clarity be provided on regional population sizes and biogeographical populations to assess against?
- Do you agree with the proposed approach to assessment, related to Offshore Ornithology?

.

12 Seascape, Landscape and Visual Impact Assessment

12.1 Introduction

This section of the Offshore Scoping Report considers the likely significant effects of the Offshore Proposed Development on seascape, landscape, and visual resources. The SLVIA Chapter provides an overview of the existing environment and context for the Offshore Proposed Development, followed by an assessment of likely significant effects for the construction, operation (including maintenance), and decommissioning phases of the Offshore Proposed Development. This chapter focusses on the effects of the Offshore Proposed Development components which includes the WTGs and their associated foundations, OSP (within the Array Areas, if required), the interconnector cables, inter-array cables, OfECC, and Landfall (below MHWS). The effects of the Onshore Transmission Infrastructure of the Arven Offshore Wind Farm are covered in the Landscape and Visual Impact Assessment Chapter within the Onshore Scoping report.

This chapter should be read alongside the following chapter:

- Chapter 16: Marine Archaeology and Cultural Heritage.

This chapter has been prepared by chartered landscape architects at Optimised Environments Limited (OPEN).

12.2 Study Area

The SLVIA study area is defined by the extent of potential significant effects arising from the key operational elements of the Offshore Proposed Development, which are the WTGs, and is defined by a radius of 60 km from the Array Areas boundary, as illustrated in Figure 12.1. Broadly, the SLVIA study area covers the landmasses of the Shetland Islands, and an area of the North Sea to the east of the Shetland Islands and Atlantic Ocean to the west. Informed by professional judgement, a 60 km SLVIA study area is defined as the outer limit of the area where significant visual effects could occur.

Institute of Environmental Management and Assessment (IEMA) Guidance (IEMA, 2015; 2017) recommends a proportionate EIA focused on the significant effects and a proportionate EIAR chapter. An overly large SLVIA study area may be considered disproportionate if it makes the understanding of the key impacts of the Offshore Proposed Development more difficult.

This is supported by Landscape and Visual Impact Assessment (LVIA) Guidance produced by the Landscape Institute (GLVIA3) (Landscape Institute, 2013). This guidance recommends that:

> *"the level of detail provided should be that which is reasonably required to assess the likely significant effects".*

It also states that:

> *"the study area should include the site itself and the full extent of the wider landscape around it which the proposed development may influence in a significant manner".*

Other wind farm specific guidance, such as NatureScot's Visual Representation of Wind Farms Guidance (NatureScot[15], 2017) recommends that Zone of Theoretical Visibility (ZTV) distances are used for defining the study area based on WTG height. This guidance recommends a 45 km radius for all WTGs greater than 150 m to blade tip. The height of current offshore WTG models now exceeds the heights covered in this guidance. The NatureScot guidance recognises that greater distances may need to be considered for larger WTGs used offshore, as is the case for the SLVIA study area for the Offshore Proposed Development. A precautionary approach is taken in defining a 60 km radius study area for the Offshore Proposed Development due to the maximum 370.5 m blade tip height (above Highest Astronomical Tide (HAT)) of the proposed WTGs. This decision is supported by the recent Scottish Government (Marine Directorate) Scoping Opinion (September 2023) for Muir Mhor Offshore Wind Farm, whose array area is located approximately 63km from the nearest point of the coastline, which concluded that the 'wind farm array area and export cable corridor to MHWS is unlikely to give rise to significant effects to coastal character and / or visual receptors and can be scoped out of the EIAR (p.28, pp. 5.12).

The SLVIA will generally focus on locations from where it may be possible to see the proposed WTGs, as defined by the Blade Tip ZTV (Figure 12.5; to Figure 12.10).The Blade Tip ZTV indicates that theoretical visibility of the Offshore Proposed Development mainly occurs within 60 km and that beyond this distance, the geographic extent of visibility will become increasingly restricted. At distances over 60 km, the lateral (or horizontal) spread of the Offshore Proposed Development will also occupy a smaller portion of available views and the apparent height (or 'vertical angle') of the WTGs would also appear very small; therefore, significant visual effects are unlikely to arise at greater distances than this, even if the WTGs are visible.

The influence of earth curvature also begins to limit the apparent height and visual influence of the WTGs visible at long distances (such as over 60 km), as the lower parts of the turbines would be partially hidden behind the apparent horizon, leaving only the upper parts visible above the skyline.

In considering the SLVIA study area, the sensitivity of the receiving seascape, landscape and visual receptors has also been reviewed, taking account of landscape designations (see Figure 12.3) and other visual receptors. The principal issues for SLVIA in terms of landscape designations are the location of the Array Areas off the east coast of the Shetland Islands coastline, and the resulting exposure to and visibility of the WTGs from locations including Local Landscape Areas, and Gardens and Designed Landscapes.

It is proposed that effects arising from the Offshore Proposed Development beyond 60 km of the Array Areas are omitted from the SLVIA chapter of the EIA, as they are unlikely to be significant. The SLVIA study area will be reviewed and amended in response to such matters as refinement of the Offshore Proposed Development, the identification of additional impact pathways and in response, where appropriate, to feedback from consultation. Feedback from consultees is requested specifically on the SLVIA study area.

[15] Scottish Natural Heritage originally published this document but was rebranded as NatureScot in May 2020.

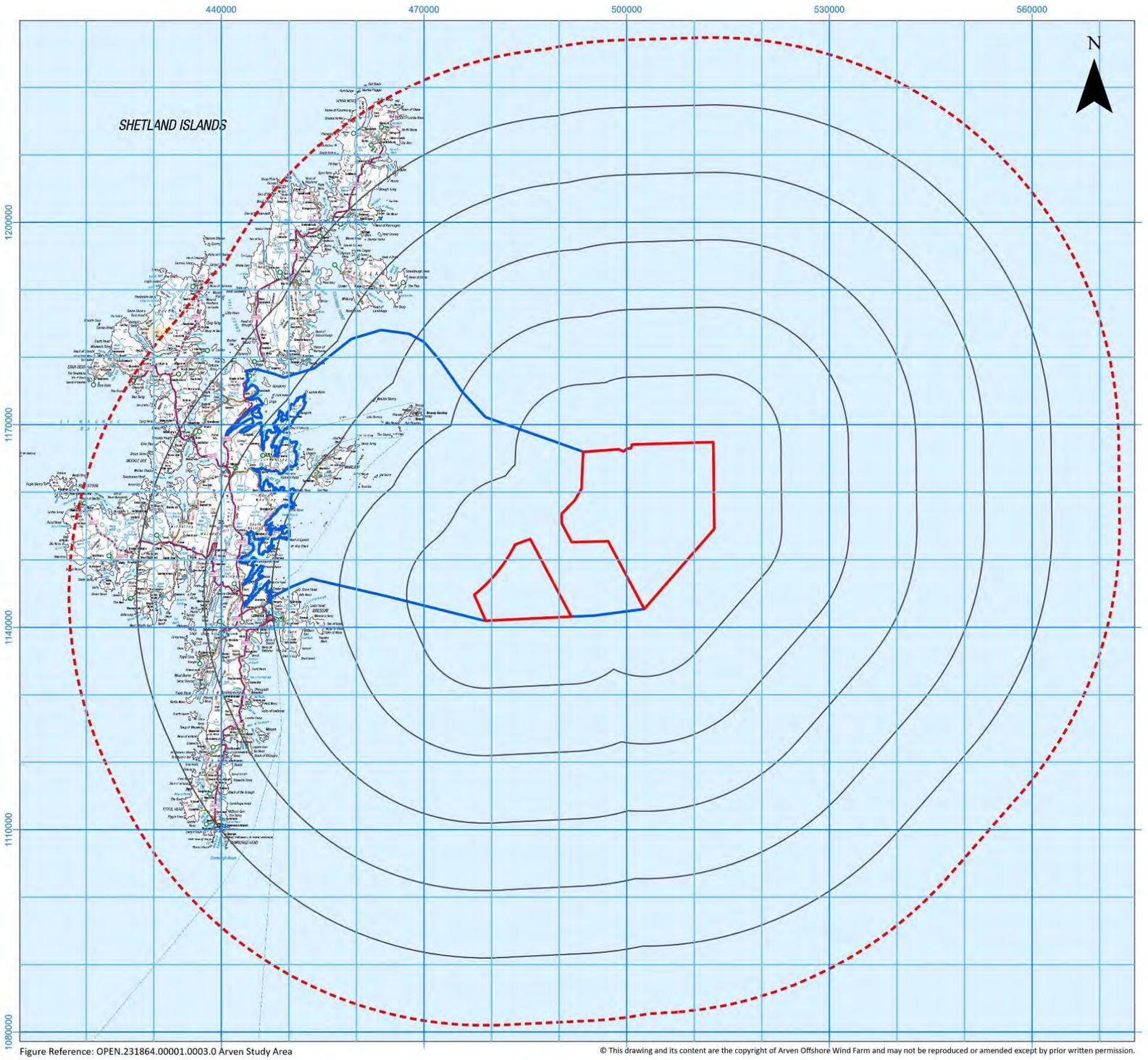


Figure Reference: OPEN.231864.00001.0003.0 Arven Study Area

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Arven Offshore Wind Farm
Scoping Report

SLVIA Study Area

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii

Notes

World Hillshade: Esri, Intermap, USGS
World Hillshade: Esri, Intermap, NASA, NGA, USGS
Image:
World Topographic Map: Esri UK, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS
World Ocean Base: Esri, GEBCO, Garmin, NaturalVue
Contains Ordnance Survey data

Coordinate System:
British National Grid

0 10 20 km
0 5.5 11 nm

Scale	Date	Drawn by	Checked by	Approved by
1:550,000 @A3	29/02/2024	RA	CW	LT

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Figure 12.1

Figure 12.1: SLVIA Study Area

12.3 Data Sources at Scoping

A summary of data sources used to inform this SLVIA chapter of the Offshore Scoping Report are presented in Table 12.1.

Table 12.1: Data sources used to inform the SLVIA scoping chapter

Title	Summary	Source	Author and year
CPRE Light Pollution and Dark Skies interactive mapping	Interactive maps of the UK's light pollution and dark skies as part of a national mapping project	https://www.cpre.org.uk/light-pollution-dark-skies-map/	CPRE 2023
Google Earth Pro (2022)	Review of aerial photography within the SLVIA study area.		Google 2022
Gardens and Designed Landscapes	Citations and mapping data for Gardens and Designed Landscape.	https://www.historicenvironment.scot/advice-and-support/listing-scheduling-and-designations/gardens-and-designed-landscapes/	Historic Environment Scotland 2023
Guidelines for Landscape and Visual Impact Assessment: Third Edition (2013)	Guidance for Seascape, Landscape and Visual Impact assessment		Landscape Institute and Institute of Environmental Management and Assessment 2013
Long Distance Walking Association	Details of long distance recreational routes	https://ldwa.org.uk/ldp/members/show_path.php?path_name=Shetland+Walks	Long Distance Walking Association accessed 2023
Guidance for applicants on using the design envelope for applications under Section 36 of the Electricity Act 1989	Guidance from Marine Scotland and the Energy Consents Unit on using the design envelope approach for applications under Section 36 of the	https://www.gov.scot/publications/guidance-applicants-using-design-envelope-applications-under-section-36-	Marine Scotland and Scottish Government Energy Consents Unit 2022

Title	Summary	Source	Author and year
	Electricity Act 1989 where flexibility is required in applications.	electricity-act-1989/pages/2/	
National Trust for Scotland: Visit Places	Location and descriptions of places of interest / attractions for recreational visitors.	https://www.nts.org.uk/visit/places	National Trust for Scotland accessed 2023
National Coastal Character Types	Mapping of coastal characterisation in Scotland.	https://www.nature.scot/professional-advice/landscape/coastal-character-assessment	NatureScot 2005
Scottish Landscape Character Types map and descriptions	Mapping of landscape characterisation in Scotland.	https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions	NatureScot 2019
The Special Qualities of the National Scenic Areas. Scottish Natural Heritage Commissioned Report No.374 (iBids and Project no 648)	Descriptions of the Special Qualities of National Scenic Areas.	https://www.nature.scot/doc/naturescot-commissioned-report-374-special-qualities-national-scenic-areas	NatureScot 2010
Wild Land Area descriptions	Descriptions of Wild Land Areas	https://www.nature.scot/doc/wild-land-areas-map-and-descriptions-2014	NatureScot 2014
NatureScot Commissioned Report 103: An assessment of the sensitivity and capacity of the	An assessment of the sensitivity and capacity of the Scottish seascape	https://www.nature.scot/doc/naturescot-commissioned-report-103-assessment-sensitivity-and-capacity-	NatureScot 2005

Title	Summary	Source	Author and year
Scottish seascape in relation to windfarms	in relation to offshore windfarms.	scottish-seascape-relation	
Assessing impacts on Wild Land Areas - technical guidance	Guidance for assessing impacts on WLAs.	https://www.nature.scot/doc/assessing-impacts-wild-land-areas-technical-guidance	NatureScot 2023
Assessing the Cumulative Impact of Onshore Wind Energy Developments	CIA guidance.	https://www.nature.scot/doc/guidance-assessing-cumulative-landscape-and-visual-impact-onshore-wind-energy-developments	NatureScot 2021
Offshore Renewables – Guidance on Assessing the Impact on Coastal Landscape and Seascape. Guidance for Scoping an Environmental Statement	Coastal landscape and seascape assessment guidance.	https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/planning-and-development-standing-advice-and-guidance-documents	NatureScot 2012
Visual Representation of Windfarms: Version 2.2	Visualisation guidance.	https://www.nature.scot/doc/visual-representation-wind-farms-guidance	NatureScot 2017
	Digital mapping.	Ordnance Survey (OS) 1: 50,000 scale raster mapping	OS 2023
	Digital terrain model.	Ordnance Survey Terrain 50 Metre Digital Terrain Model (DTM)	OS 2023

Title	Summary	Source	Author and year
	Mapping of ferry routes.	Ferry routes shown on Ordnance Survey mapping	OS 2022
National Scenic Areas	National Scenic Area GIS dataset.	https://www.data.gov.uk/dataset/8d9d285a-985d-4524-90a0-3238bca9f8f8/national-scenic-areas-scotland	Scottish Government 2022
Wild Land Areas	Wild Land Area GIS dataset.	https://www.data.gov.uk/dataset/6bf02e7c-c3d6-4866-85ab-92471f73b2a3/wild-land-areas	Scottish Government 2014
National Planning Framework 4	National planning policy context.	https://www.gov.scot/publications/national-planning-framework-4/	Scottish Government 2023
Shetland Core Paths Plan	Mapping of Core Paths within the Shetland Islands Council area.	https://www.shetland.gov.uk/downloads/download/145/core-paths-plan-maps	Shetland Islands Council 2009
Shetland Local Development Plan	Seascape and landscape relevant planning policy within the Shetland Islands Council area.	https://www.shetland.gov.uk/development-plans-policy/development-plans/2	Shetland Islands Council 2014
Shetland Islands Regional Marine Plan (Amended draft) and Coastal Values background paper 'A Community Shaped by the Sea – Understanding community value and	Data relating to the value and use of different areas of the Shetland coastline.		Shetland Islands Marine Planning Partnership 2021

Title	Summary	Source	Author and year
use of the Shetland coastline'			
National Cycle Routes	Mapping of National Cycle Routes within the Shetland Islands.	https://www.sustrans.org.uk/find-other-routes/shetland-islands-sumburgh-to-lerwick-and-norwick/	Sustrans 2023
Shetland Coastal Character Assessment (2nd Edition)	Local coastal character assessment for the Shetland Islands.	https://www.shetland.uhi.ac.uk/research/marine-spatial-planning/marine-spatial-planning-publications/shetland-coastal-character-assessment-publications/	University of the Highlands and Islands Shetland and Shetland Marine Planning Partnership 2021

12.4 Baseline Environment

12.4.1 Coastal Character

In Scotland, seascape characterisation is defined by NatureScot (2018) as:

'the focus is on the coast and its interaction with the sea and hinterland, relationships that are quite distinctive in the Scottish context'

Coastal character is defined as (NatureScot 2018):

'distinct, recognisable and consistent pattern of elements on the coast, land and sea that makes one part of the coast different from another'

And is made up of the margin of the coastal edge, its immediate hinterland, and areas of sea.

The extent of the coast is principally influenced by the dominance of the sea in terms of physical characteristics, views, and experience. The landward extent of the coast can be narrow, for example where edged by cliffs or settlement; or broad where it includes raised beaches, dunes, or more open coastal pasture or machair. The major determinant in defining the landward and seaward components of the coast is the sea - the key characteristic.

The SLVIA will consider coastal character effects within the SLVIA study area.

Given the definition in the NatureScot coastal character assessment guidance, the assessment of coastal character effects in this SLVIA focuses on areas of onshore landscape with views of the coast or seas/marine environment, in other words the 'coastal character', on the premise that the most important effect of offshore windfarms is on the perception of the character of the coast.

The coastal character of the SLVIA study area is defined at the national level within the research report NatureScot Seascapes Study (Scott *et al.*, 2005). This broad classification still stands, and five Coastal Character Types (CCTs) are located within the 60 km study area, as shown in Figure 12.2.

At the local level, the coastal character of the SLVIA study area has been characterised by UHI Shetland on behalf of the Shetland Marine Planning Partnership, with guidance from NatureScot and Shetland Islands Council (SIC), in the (2021) 'The Shetland Coastal Character Assessment' (SCCA).

The (2021) SCCA states that the study assessment boundaries cover terrestrial, intertidal, and marine environments along Shetland's 2,702 km long coastline. The SCCA focuses on the intertidal area and how the immediate coastal landscape up to 1 km inland and inshore waters out to 12 nm, relate to the coastal character.

The (2021) SCCA identifies 44 Coastal Character Areas (CCAs) around the coast of the Shetland Islands, based on landscape and coastal features. Each CCA comprises one, or more, of 14 Coastal Character Types (CCTs) which are classified as:

> *'Distinct types of coast that are similar in character. They may be found in different areas of the islands but share comparable physical and aesthetic features.'*

Within certain CCTs, the 2021 SCCA also characterises unique 'Coastal Character Sub-Types'.

Taking into consideration the considerable distance between the coastline and the Array Areas as well as the geographic extent of the ZTV (Figure 12.5 - Figure 12.10), potential impacts on coastal character may be experienced over a relatively wide area; Therefore, it is considered that the regional-scale NatureScot CCTs would provide a resolution of data that is more commensurate to the nature of the potential impact arising from the Offshore Proposed Development, and it is proposed that these coastal character descriptions will inform the baseline assessment and the assessment of the impacts on the visual aspects of perceived character resulting from the Offshore Proposed Development the SLVIA study area.

12.4.2 Landscape Character

Published Landscape Character Assessments describe the baseline character of the landscape within the SLVIA study area at a national level.

NatureScot's landscape character map (NatureScot, 2019) and associated Landscape Character Type (LCT) descriptions will form the basis of the baseline landscape character description of the SLVIA study area and the assessment of the impact on visual aspects of perceived character resulting from the Offshore Proposed Development within the SLVIA study area.

In total, there are eight LCTs within the 60 km SLVIA study area, shown on Figure 12.2, and listed below:

- LCT 349: Major Uplands
- LCT 350: Peatland and Moorland
- LCT 351: Undulating Moorland with Lochs
- LCT 352: Inland Valleys
- LCT 353: Farmed and Settled Lowlands and Coast
- LCT 354: Farmed and Settled Voes and Sounds
- LCT 355: Coastal Edge
- LCT 356: Small Uninhabited Islands

NatureScot's (2019) report 'Landscape Character Assessment: Shetland – Landscape Evolution and Influences' provides information on how the landscape within the SIC area has evolved. It is intended to complement the 2019 LCT dataset and this will be referred to in the assessment of the effects on landscape character where relevant.

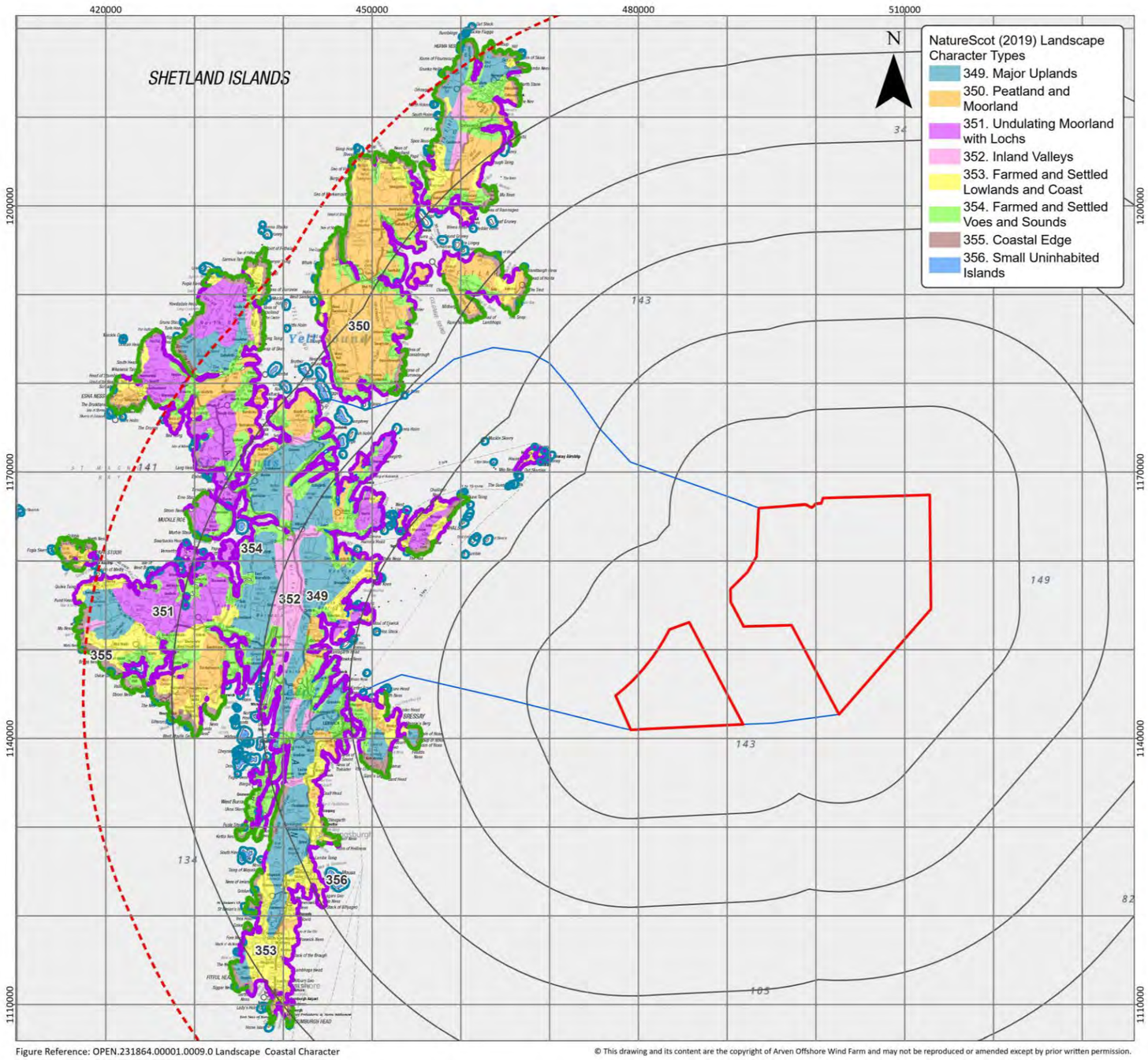

Figure Reference: OPEN.231864.00001.0009.0 Landscape Coastal Character

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Arven Offshore Wind Farm
Scoping Report

Landscape and Seascape Character

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii

NatureScot/SNH (2005) Coastal Character Types

- Coast
- Coastal Island
- Low Rocky Island Coasts
- Remote High Cliffs
- Rocky Coastline / Open Sea Views

Notes

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World Ocean Reference: Esri UK, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS
Image:
World Ocean Reference: Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
World Ocean Base: Esri, GEBCO, Garmin, NaturalVue

0 10 20 km
0 4 8 nm
Coordinate System: British National Grid

Scale	Date	Drawn by	Checked by	Approved by
1:420,000 @A3	29/02/2024	RA	CW	LT

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Figure 12.2

Figure 12.2: Landscape and Seascape Character

12.4.3 Landscape Planning Designations and Defined Wild Land Areas

There are no designations specifically to protect the character of the seascape within the SLVIA study area. There are, however, terrestrial areas within the 60 km SLVIA study area that have been attributed a landscape planning designation and some of these include areas of sea, close to the coast.

These landscape planning designations and defined areas include National Scenic Areas (NSAs) which are designated by NatureScot and safeguarded by Scotland's planning system; Wild Land Areas (WLAs) which are defined and mapped by NatureScot and recognised in NPF4; Gardens and Designed Landscapes (GDLs), which are selected for inclusion in the Inventory of Gardens and Designed Landscapes by HES and protected by both national and local development plan policy; and locally important Local Landscape Areas (LLAs), which are designated through the SIC (2014) adopted 'Shetland Local Development Plan' (SLDP) (see Figure 12.3).

12.4.3.1 National Scenic Areas

The Shetland NSA lies within the SLVIA study area (see Figure 12.3). The NSA covers seven geographically distinct areas: Fair Isle, Southwest Mainland, Shetland, Foula, Muckel Roe, Eshaness, Fethaland, and Hermaness. Five of the areas are located across the western coastline of Shetland, and two cover the remote islands of Foula and Fair Isle. The closest part of the NSA to the Array Areas is Southwest Mainland, Shetland, at approximately 37.2 km. It is proposed that the NSA is included in the SLVIA, owing to its association with the coast and seascape across the varied areas. The SLVIA will assess the likely effects of the Offshore Proposed Development on the NSA, based on the NatureScot citation (2010) 'The Special Qualities of the National Scenic Areas'. Special Qualities of the NSA considered susceptible to change as a result of the Offshore Proposed Development, and therefore to be considered in the SLVIA, include:

- Coastal views both close and distant;
- A sense of remoteness, solitude and tranquility;
- Northern light.

Considering the nature of the remaining Special Qualities described in NatureScot citations (2010), the geographic location of the NSA areas which is largely focused on the western coastline of the Shetland Islands, the intervening distance to the Array Areas, and the limited theoretical visibility within large parts of the NSA (Figure 12.5), it is proposed that effects on the remaining Special Qualities of 'the stunning variety of the extensive coastline', 'Coastal settlement and fertility within a large hinterland of unsettled moorland and coast', 'the hidden coasts', 'the effects and co-existence of wind and shelter', 'the notable and memorable coastal stacks, promontories and cliffs', and 'the distinctive cultural landmarks' are not relevant and are proposed to be scoped out of the SLVIA.

12.4.3.2 Wild Land Areas

There is also the Ronas Hill and North Roe Wild Land Area (WLA) (Figure 12.3 and Figure 12.4). WLA are defined and mapped by NatureScot and recognised in NPF4 as a nationally important mapped interest, but not as a statutorily protected designation. WLAs are afforded protection for their wildness qualities, they are not protected in the way that National Parks or NSAs are for their scenic qualities. In addition, Scottish Government (2023) National Planning Framework 4 (NPF4) advises that where a development proposal is in an area identified as wild land in the NatureScot Wild Land Areas map it must be supported by a wild land

impact assessment. The Offshore Proposed Development is not in an area identified as wild land, and the Array Areas are located a minimum range of 57.4 km from the WLA boundary. NPF4 advises that:

> *'Buffer zones around wild land will not be applied, and effects of development outwith wild land areas will not be a significant consideration.'*

The Description of Wild Land Area – 2017 (NatureScot, 2017) pertinent to the Ronas Hill and North Roe WLA (no 42) notes that:

> *The whole area is very open and exposed and influenced strongly by the sea, being open to the Atlantic on the west and bordered by the long narrow inlet of Ronas Voe to the south.*

This suggests that the key views out to sea that are influential to the perception of wildness are to the west and south. The Offshore Proposed Development is located to the south-east round to the east-south-east of the WLA. The (NatureScot, 2017) Description notes that:

> *To the east, the WLA gradually merges into an area of dispersed settlement, crofting and infrastructure, in addition to prominent masts upon Collafirth Hill. Distant views also include Europe's largest oil terminal at Sullom Voe.*

This suggests that the perception of wildness is already diminished in the direction of the Offshore Proposed Development. Taking this and the distance of over 57.4 km into account it is therefore proposed that a wild land impact assessment is not required and effects on the Ronas Hill and North Roe WLA is scoped out of the SLVIA.

12.4.3.3 Gardens and Designed Landscapes

There are four GDLs within the SLVIA study area (see Figure 12.3): Belmont House, Brough Lodge, Lunna House, and Gardie House.

Belmont House and Gardie House GDLs do not fall within the ZTV of the WTGs within the Array Areas (see Figure 12.3 and Figure 12.5). Due to the lack of theoretical visibility of the Project there would be no effects on these designated areas and therefore assessment of Belmont House and Gardie House GDLs is scoped out of the SLVIA.

The SLVIA will include an assessment of the likely effects of the Offshore Proposed Development on the Brough Lodge and Lunna House GDLs.

12.4.3.4 Local Landscape Areas

Local Landscape Areas (LLAs) are defined and protected through planning policy in the SIC (2014) SLDP. The location and extent of 'proposed' LLAs is identified in SIC draft Supplementary Guidance (SG) (2014) 'Supplementary Guidance – Local Landscape Areas – Consultation Draft 2014' with the stated purpose being to 'ensure sympathetic siting and design of new development within the Local Landscape Areas.'. It is noted on the SIC website (at https://www.shetland.gov.uk/development-plans-policy/development-plans/2) that this

document will be 'considered for adoption by the Council in the coming period'.. There are seventeen LLAs within the SLVIA study area (see Figure 12.3):

- LLA 1: Ronas Hill
- LLA 2: Nibon and Mangaster
- LLA 3: Vementry and West Burrafirth
- LLA 4: Papa Stour and Sandness
- LLA 5: Walls & Vaila
- LLS 6: Culswick and Westerwick
- LLA 7: Weisdale
- LLA 8: Scatness and Sumburgh
- LLA 9: No Ness and Moussa
- LLA 10: Aith Ness and Noss
- LLA 11: Gletness and Skellister
- LLA 12: Lunna Ness and Lunning
- LLA 13: Wick of Tresta
- LLA 14: Colvadale and Muness
- LLA 15: Haroldswick and Skaw
- LLA 16: Gloup Voe and Bluemull Sound
- LLA 17: West Sandwick to Gloup Holm

The LLAs indicate heightened value and this will be a consideration when defining sensitivity in the visual assessment and the assessment of effects on coastal and landscape character where these are coincidental. When assessing the effects on coastal and landscape character within areas that are also proposed LLAs the key characteristics, designation statement and development guidelines contained in the Supplementary Guidance will be considerations in relation to the relevant, coincidental geographical areas and the assessment of the effects upon them. The assessed effects on the relevant individual LLAs will then be drawn out for clarity. It is proposed that impacts on LLAs will not, in themselves, be assessed in the SLVIA. This is to avoid double counting as the impacts on these areas will be covered elsewhere. Where significant effects are identified within areas that are designated as LLAs this will be noted in the SLVIA.

12.4.3.5 Summary

In summary, the landscape designations and defined areas which will be assessed within the SLVIA are listed below:

- Shetland National Scenic Area, assessment of the Special Qualities 'Coastal views both close and distant', 'A sense of remoteness, solitude and tranquility', and 'Northern light';
- Brough Lodge Garden and Designed Landscape;
- Lunna House Garden and Designed Landscape.

Agreement to this is sought through this scoping exercise, in order to enable the SLVIA to be focused on key considerations.

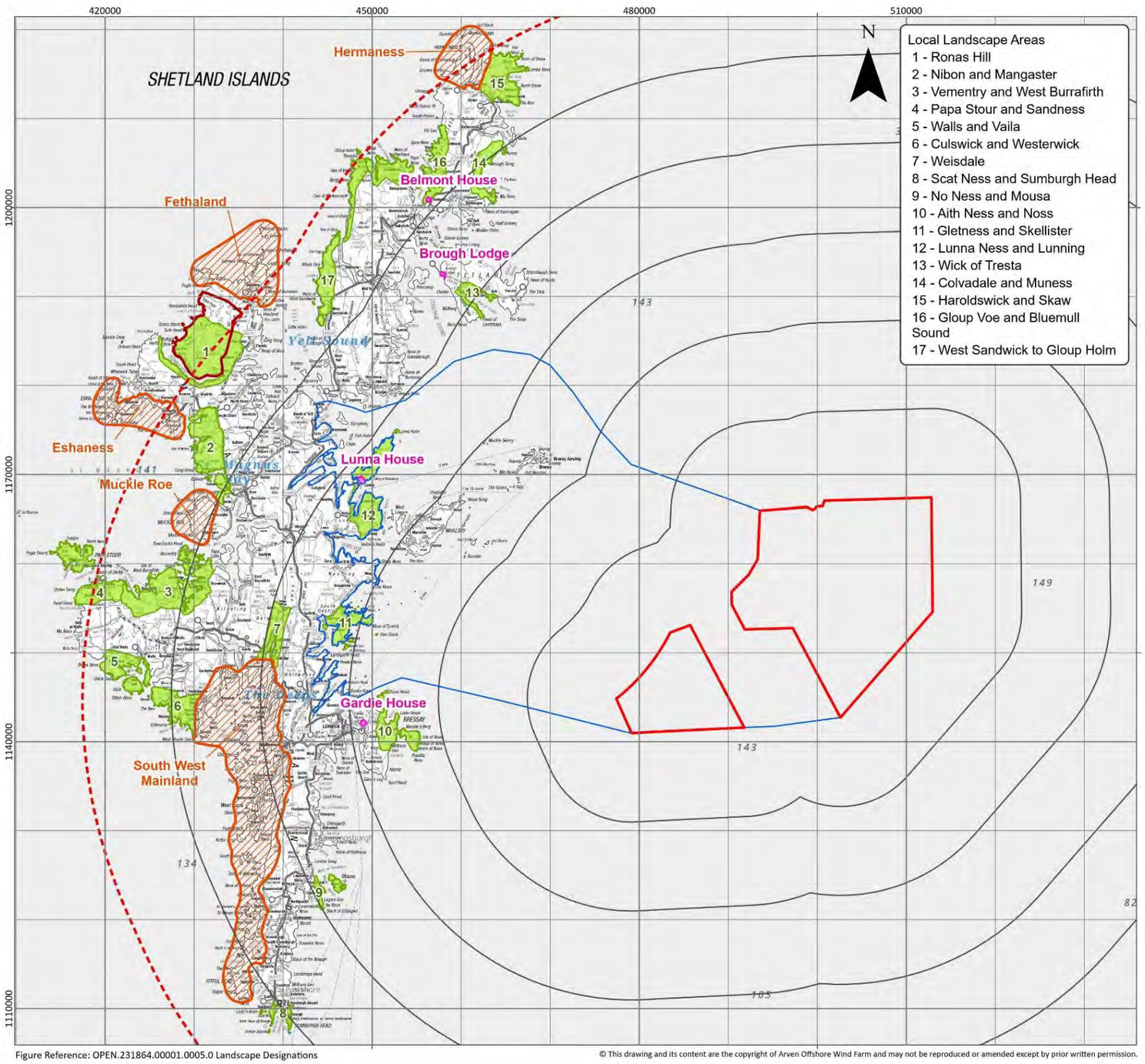

Figure Reference: OPEN.231864.00001.0005.0 Landscape Designations

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Landscape Designations

Legend

- Array Areas
- 60km Study Area
- Offshore Export Cable Corridor Area of Search
- 10km Radii
- Garden and Designed Landscape
- Shetland National Scenic Area
- Ronas Hill and North Roe Wild Land Area
- Local Landscape Area

Notes

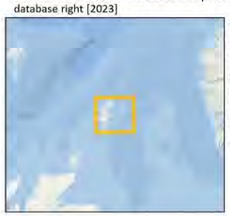

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Figure 12.3

Figure 12.3: Landscape Designations

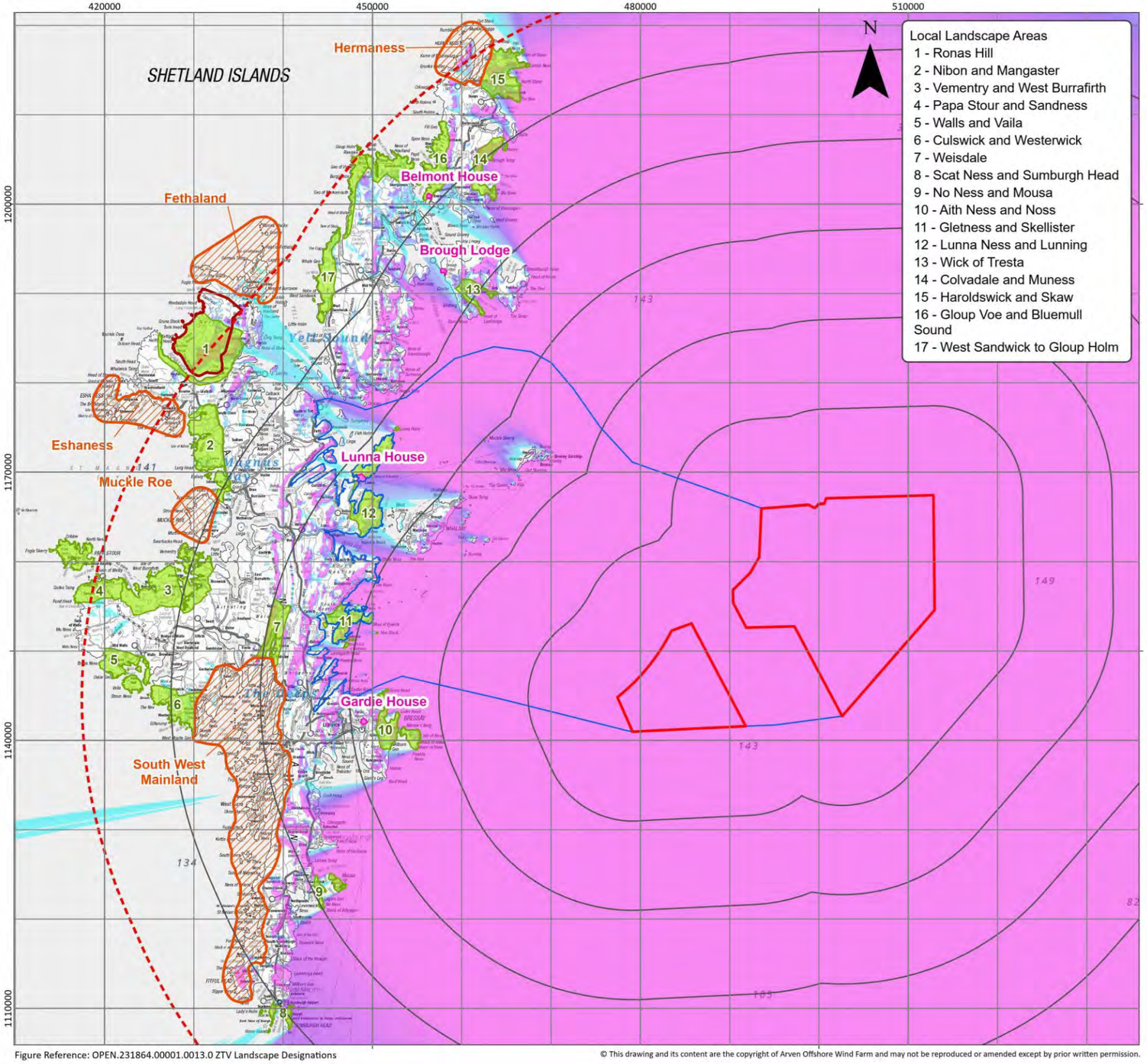

Figure Reference: OPEN.231864.00001.0013.0 ZTV Landscape Designations

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Landscape Designations with Blade Tip ZTV

Legend

- Array Area
- 60km Study Area
- Offshore Export Cable Corridor Area of Search
- 10km Radii
- Garden and Designed Landscape
- Shetland National Scenic Area
- Ronas Hill and North Roe Wild Land Area
- Local Landscape Area

Zone of Theoretical Visibility
- High Visibility
- Low Visibility

Notes

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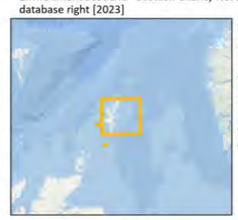

World Ocean Reference: Esri UK, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS
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World Ocean Reference: Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
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Figure 12.4

Figure 12.4: Landscape Designations with Blade Tip ZTV

12.4.4 Visual Baseline

12.4.4.1 Views and Visual Amenity

The visual baseline experienced from within the SLVIA study area is highly varied. Published NatureScot (2019) LCT descriptions offer broad descriptions that helpfully provide an overview of the diversity of coastal views characteristic to the Shetland Islands. These LCTs are shown on Figure 12.2. The following provides a summary of the relevant information and indicates the strong association between the diverse landscape/coastline and the types of views experienced from these locations:

- LCT 349 - The high grounds of the uplands affords panoramic views of the surrounding lowlands, coastlines and seascapes in clear weather;
- LCT 350 - Wide views are experienced from open and exposed areas of peatland and moorland in the island's interior;,
- LCT 351 - Occasional expansive views gained across the irregular landforms and broad undulations of the undulating loch and moorland landscapes;
- LCT 352 - Within the inland valley landscapes larger valleys generally have few sea views, although those closer to the coast have views along the valleys and up to the skylines, occasionally opening up to the sea and adjoining coastal farmland;
- LCT 353 - From the farmed and settled lowlands landscapes are generally open with constant views of the coastline, and across voes and sounds to other land, with isolated elevated views from occasional low hills;
- LCT 354 - From the farmed and settled voes and sounds landscapes views are more complex, changing orientation and composition as headlands overlap and interlock with voes, sounds, and the open sea, and bay landforms focusing views on the coastal edge or out to sea and beyond to other land;
- LCT 355 - From the coastal edge the diversity of coastal scenery allows for a wide variety of coastal views of distant horizons, nearby islands and shore lines. From a few cliff-top paths, there are intimate views of coastal features, revealing their detailed structure and scale;
- LCT 356 - the small uninhabited islands are frequently the focus of views from neighbouring inhabited islands and Mainland, Shetland, interrupting the seascape and providing foreground interest, seen as a flat or domed silhouette in the sea, usually free from modern structures.

The east coast of the Shetland Islands, nearest to the Array Areas within the study area, is generally settled or rural in character. The resultant dispersal or concentrations of people within these areas and using the connecting road network influences where people are likely to be within the landscape and the locations from where they may gain visibility of the Offshore Proposed Development. On Mainland, Shetland, the nearest section (within approximately 40 km of the Array Areas) extends from Sandwick in the south to Lunna Ness in the north. There are numerous settlements from which people would gain views of the surrounding landscape / seascape along this complex section of coastline, including: Lerwick, Leebitton, Burravoe, Bremirehoull, Aithsetter, Cunningsburgh, Fladdabister, Quarff, Gulberwick, Gott, Wadbister, Veensgarth and Vidlin. The settlement pattern within this part of Mainland, Shetland also includes scattered groups of properties and individual dwellings.

The closest main inhabited islands, within approximately 30 km of the Array Areas, include Out Skerries, Whalsay, and Bressay. As with Mainland, Shetland, these islands are predominantly rural, with small settlements including: Bruray, Isbister, Huxter, Symbister, Clate, Gunnista, and Mail.

The settlement pattern across much of the rest of the Shetland Islands is one of scattered small settlements, groups of properties, and individual properties, often in close proximity to 'A' and 'B' roads and strung out along the coastline.

12.4.4.2 Zone of Theoretical Visibility

The bare ground ZTV is shown in Figure 12.5 with larger scale versions presented in Figure 12.6 - Figure 12.10. The ZTV shows the main area in which the WTGs would theoretically be visible, highlighting the different groups of people (visual receptors) who may experience views of the WTGs located within the Array Areas and assisting in the identification of viewpoints where they may be affected. The ZTV is based on floating wind turbines of 370.5 m to blade tip above Highest Astronomical Tide (HAT) and represents a likely worst case scenario for the SLVIA considered in the Scoping assessment, which has been derived from turbines spaced evenly along the boundary of the Array Areas at this early stage in the process.

The ZTV illustrates the 'bare ground' situation based on an OS terrain model and does not consider the screening effects of either vegetation, buildings, or other local features that may prevent or reduce visibility. Similarly, the ZTV does not factor in the potential reduction in visibility that might be experienced 'in actuality' as a result of visibility conditions and weather. By using a bare ground elevation model, the results will be an over-representation of maximum visibility, as many areas could, in reality, be blocked by surface features not included in the model. A further limitation of the ZTV is that it indicates 'higher' or 'lower' theoretical visibility based on the number of WTGs visible, not on the amount of the WTG visible. Therefore, areas indicated with higher visibility (in terms of the number of visible WTGs) may have views of very small amounts of these WTGs at long range.

The ZTV illustrates that there could be extensive theoretical visibility of the WTGs from areas of open water within the North Sea. Theoretical visibility from open water across inshore sounds and voes is more fragmented as a result of the screening effect of intervening landform, though extensive where there these waterbodies open up to the sea. The terrestrial areas of the SLVIA study area with highest theoretical visibility of the WTGs within the Array Areas lie mainly to the east of the Shetland Islands, towards the North Sea, from the closest lower-lying coastal edges on Mainland, Shetland and the islands of Fetlar, Bruray, Whalsay, and Bressay. Visibility within these areas tends to be greatest where the coastline is orientated towards the Array Areas, and somewhat reduced from more complex and indented sections of the coast. The ZTV within the wider SLVIA study area to the west is much more fragmented, varying and limited to higher points, such as hills and ridgelines, within the interior of the Shetland Islands. There are highly fragmented, low levels of theoretical visibility indicated from much of the western coast of the Shetland Islands.

Owing to the generally low incidence of tree cover and absence of dense concentrations / large built form within the Shetland Islands, it is anticipated that the pattern and extent of actual visibility would be similar to theoretical visibility in terms of the visual influence of the WTGs within the Array Areas.

12.5 Representative Viewpoints

A proposed list of representative LVIA viewpoints is presented in Table 12.2 and shown on Figure 12.5 to Figure 12.10; based on the ZTV for the WTGs within the Array Areas, and the landscape and visual receptors

described above. A number of the proposed viewpoints have been further validated through field work by SLVIA technical experts. The viewpoints represent locations within the SLVIA study area at which sensitive visual receptors have the potential to be significantly affected. The selection of the viewpoints considers the representation of different landscape and coastal character receptors, within which they are located; and the surrounding context so that the visual assessment can inform the wider assessment. While the aim is to achieve a distribution of viewpoints from different directions and distances across the SLVIA study area, the priority is to ensure that the closer range or most sensitive receptors with the greatest potential to be significantly affected are fully represented. The viewpoint locations will be micro sited during photography field work to ensure suitable locations are used.

Comment on the proposed viewpoint locations is invited as part of this request for a Scoping Opinion. Visualisations and figures will be produced to NatureScot standards set out in (2017) 'Visual Representation of Wind farms: Guidance, Version 2.2'.

Table 12.2: Proposed Representative Viewpoint Locations

ID	Description (*indicates proposed night-time visualisation location)	Approx. Grid Red.		Approx. Distance to Array Area (km)	Justification
1	Bruray*	468478	1171745	24.6	Representative of people in settlement. On Core Path. Most easterly point of UK and one of the closest points of land to the Array Areas.
2	Bressay, Noss-sound	452683	1141005	25.0	Representative of visitors to Noss-sound, near the parking area for the (seasonal) ferry crossing to the Isle of Noss (NNR). Also Core Path. Within LLA 10 Aithness and Noss.
3	Lerwick to Bruray passenger ferry	456068	1157987	25.1	Representative of users of the passenger ferry route between Lerwick-Bruray.
4	Isbister and Nisthouse, Whalsay	458000	1164082	27.4	Representative of people in settlement at Isbister and Nisthouse, Whalsay.
5	Ling Ness headland	448878	1154471	30.1	Representative of users of Core Path. Identified in SIC (2021) Coastal Values report as location of popular beaches. Within LLA 11 - Gletness and Skellister.
6	Lerwick, Staney Hill	446240	1142217	31.3	Representative of people in settlement at Lerwick within the ZTV, and users of NCR1.

ID	Description (*indicates proposed night-time visualisation location)	Approx. Grid Red.		Approx. Distance to Array Area (km)	Justification
7	B9075, south of Brettabister	447513	1156651	32.2	Representative of road users on the B9075 and cyclists on NCR 1.
8	A970, south of Girlsta	442495	1150137	35.3	Representative of people in scattered settlement at Girlsta, road users on A970, and cyclists on NCR 1.
9	Funzie Bay	466557	1189670	35.9	Users of Core Path. Visitors to nature reserve and rugged geos along coast.
10	Aithsetter	444266	1130543	36.1	Representative of people in settlement at Aithsetter. Identified in SIC (2021) Coastal Values report as near 'popular places to visit', and within a broad area of 'Inspiring Coastline'.
11	A970, Fladabister	443005	1132027	36.7	Representative of road users on A970, cyclists on NCR 1, and people on nearby Core Path route and in nearby settlement at Fladibister.
12	Lunna House	448559	1169136	37.7	Representative of visitors to Lunna House GDL. Identified in SIC (2021) Coastal Values report as 'Area of coast of high value or inspiration'. Within Lunna Ness and Lunning LLA.

ID	Description (*indicates proposed night-time visualisation location)	Approx. Grid Red.		Approx. Distance to Array Area (km)	Justification
13	Sandwick	443673	1124900	38.9	Representative of people in settlement. Users of Core Path. Within LLA 9 No Ness and Mousa.
14	Fetlar, Houbie	462288	1190683	39.9	Representative of people in settlement at Houbie. Identified in SIC (2021) Coastal Values report as an 'inspiring coastline', recreational point of access to shore, as popular place to visit, and near notable beach. Within LLA 13 - Wick of Tresta.
15	Burravoe, near Wester Ayre	451837	1179304	41.6	Representative of people in settlement at Burravoe. On Core Path at beach near the settlement. Identified in SIC (2021) Coastal Values report as recreational point of access to shore, and area of coast of high value or inspiration.
16	Levenwick	440509	1120506	43.7	Representative of people in settlement at Levenwick. Also close to A970. Beaches at Levenwick recognised as popular destination in SIC (2021) Coastal Values report.
17	Muness Castle (remains)	462977	1201158	46.7	Representative of views from historic place of interest. Within LLA 14 - Colvadale and Muness

ID	Description (*indicates proposed night-time visualisation location)	Approx. Grid Red.		Approx. Distance to Array Area (km)	Justification
18	A970, north of Exnaboe	439083	1113144	48.8	Representative of users of A970, NCR1 and Core Path at this point.
19	Sumburgh Head	440889	1108343	50.3	Representative of visitors to this popular location. On NCR1 and Core Path. recognised as popular destination in SIC (2021) Coastal Values report. Within Scat Ness and Sumburgh Head LLA.
20	North of Haroldswick, Beach Road	464052	1212439	55.1	Settlement at Haroldwick. Close to popular attractions Unst Heritage Centre and Unst Boat Haven. On NCR1. Identified in SIC (2021) Coastal Values report as 'inspiring coastline and near 'inspiring coastline point', recreational point of access to shore. Within LLA 15 - Haroldswick and Skaw.
21	Noss Hill, Mainland, Shetland west of Loch Spiggie	436136	1115603	49.9	Representative of Shetland Islands National Scenic Area (Southwest Mainland, Shetland)

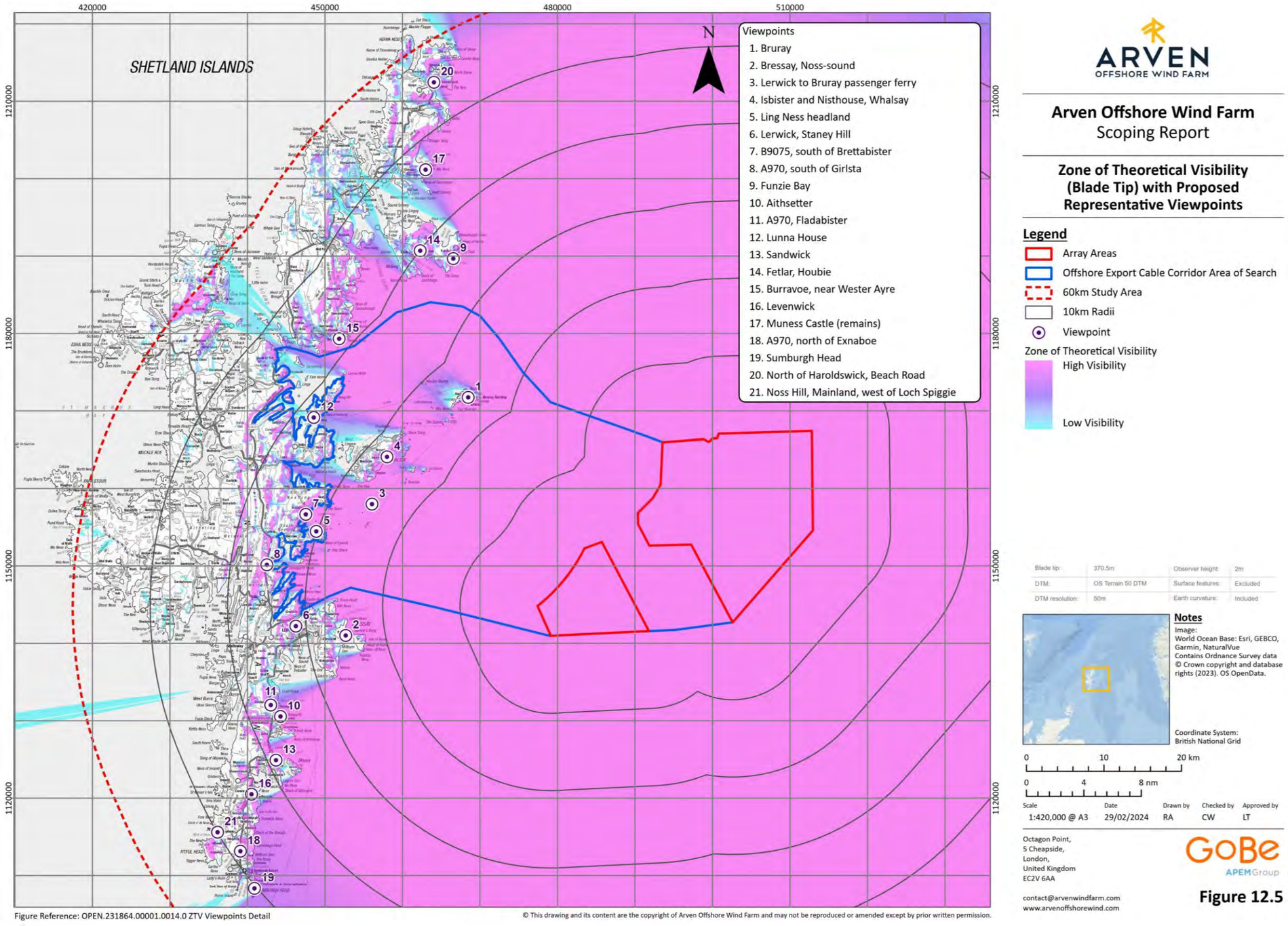
12.5.1.1 Visual Receptors

The principal visual receptors in the study area are likely to be found along the closest sections of coastline. These include people within settlements, driving on roads, visitors to tourist facilities or historic environment assets, and people engaged in recreational activity such as those using walking or cycle routes.

An assessment will be undertaken in the SLVIA for those visual receptors that are most susceptible to changes (see Figure 12.11), which may experience significant visual effects as a result of the Offshore Proposed Development and will focus on visual receptors where the sea is a strong influence in the baseline view, along the coastlines of the SLVIA study area and immediate hinterland, including:

Coastal settlements:

- Lerwick;
- Leebitton;
- Bremirehoull;
- Aithsetter;
- Cunningsburgh;
- Fladdabister;
- Quarff;
- Gulberwick;
- Gott;
- Wadbister;
- Veensgarth; and
- Vidlin.
- Recreational routes – walkers, equestrians and cyclists using public rights of way, including Core Paths, and National Cycle Route 1. Although there are no long-distance walking routes identified on OS mapping, the Long Distance Walking Association contains several published local guidebooks and identifies seven distinct routes which connect along the coastline of the Shetland Islands. Detailed assessment of recreational routes generally will be undertaken from representative viewpoint locations.
- Vehicular routes – main vehicular transport routes including the A968, A970, A971, B9071, B9073, B9074, B9075, B9076, B9078, B9079, B9081, B9082, B9083, B9084, B9088, and B9122. There are commercial ferry services which connect the Shetland Islands (docking at Lerwick) to mainland, Scotland and Orkney. Local commercial ferry services run shorter routes between the main Shetland Islands and smaller islands around the coast (e.g., Fetlar, Bruray, Whalsay, Bresay, Foula, and Fair Isle).
- Visitors to tourist attractions/ facilities and places of interest – The varied coastline of the Shetland Islands provides opportunities for numerous recreational activities, as identified in the SIC (2021) 'A Community Shaped by the Sea – Understanding community value and use of the Shetland coastline', which include: coasteering, diving and snorkelling, fishing from shore, kayaking, windsurfing, surfing, rock climbing, wild swimming, sailing, and walking. Other popular informal recreation facilities include beaches, public open space, common land, coastal caravan, and camping sites.



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Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints

Legend
- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii
- Viewpoint

Zone of Theoretical Visibility
- High Visibility
- Low Visibility

Blade tip:	370.5m	Observer height:	2m
DTM:	OS Terrain 50 DTM	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

Notes
Image:
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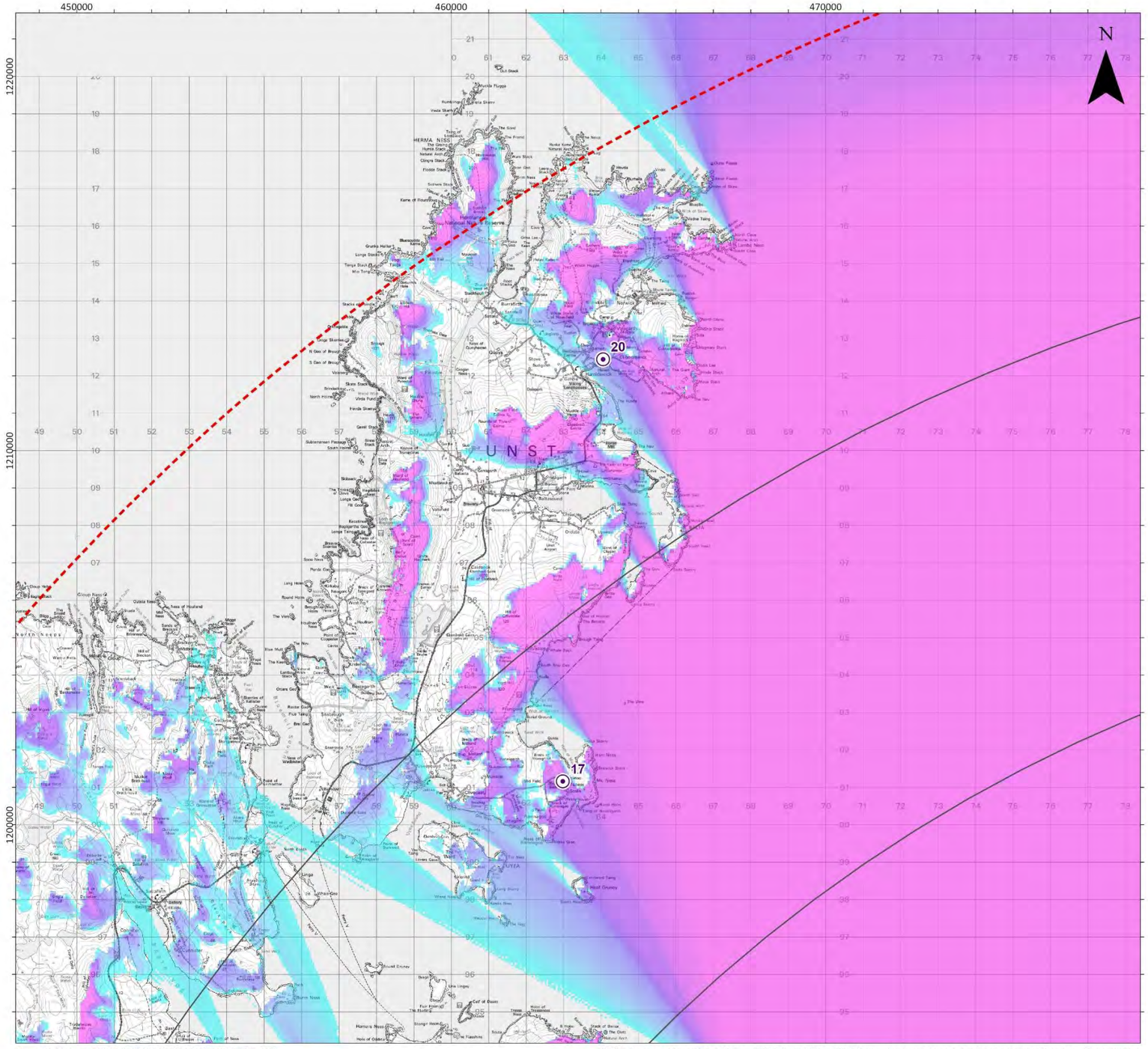
Figure 12.5

Figure 12.5: Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints



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Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (1 of 5)

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii

Zone of Theoretical Visibility
- High Visibility
- Low Visibility

Viewpoint
- 17. Muness Castle (remains)
- 20. North of Haroldswick, Beach Road

Blade tip:	370.5m	Observer height:	2m
DTM:	OS Terrain 50 DTM	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

Notes
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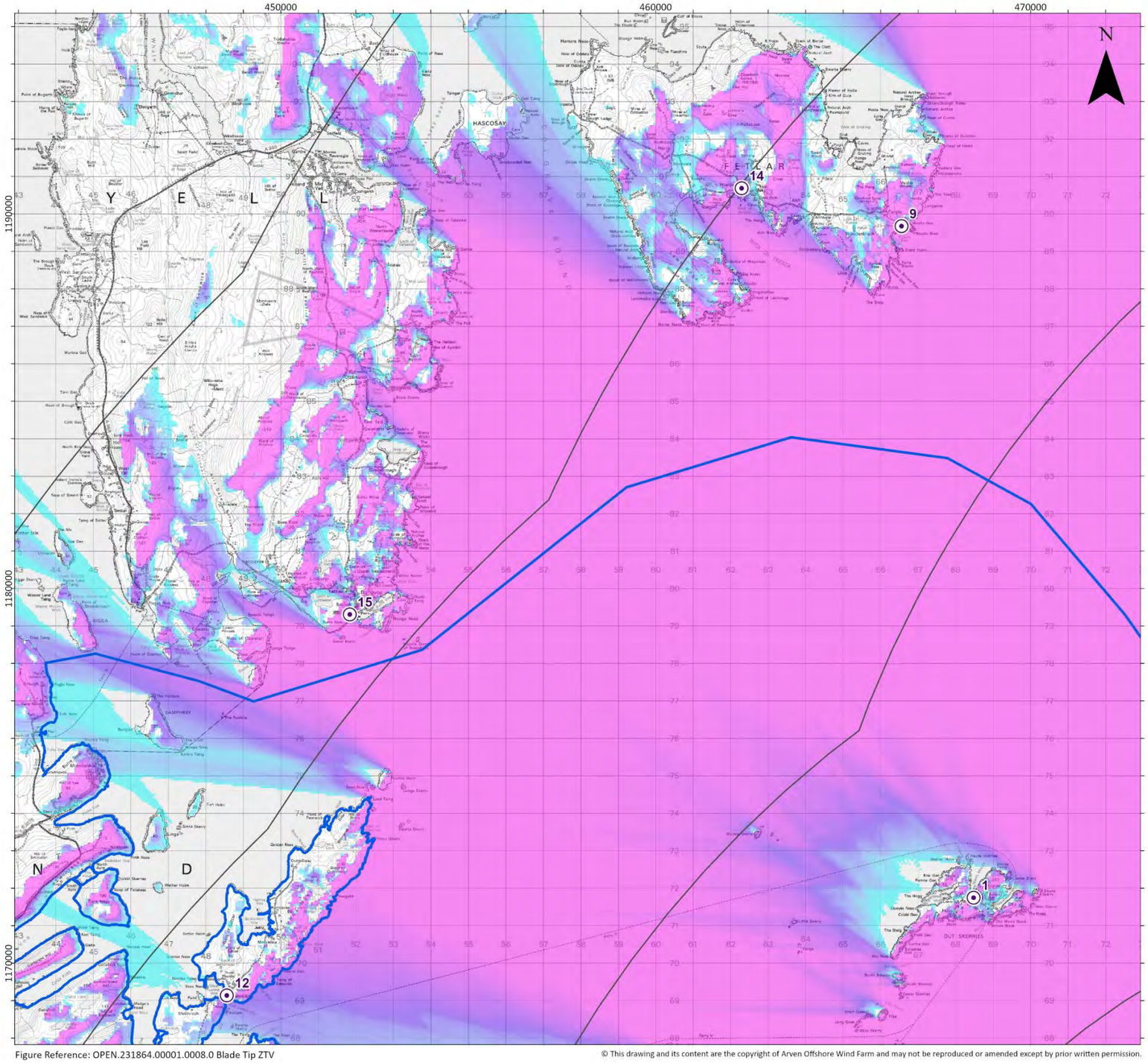
Figure 12.6

Figure 12.6: Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (1 of 5)



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Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (2 of 5)

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii

Zone of Theoretical Visibility
- High Visibility
- Low Visibility

Viewpoint
1. Bruray
9. Funzie Bay
12. Lunna House
14. Fetlar, Houbie
15. Burravoe, near Wester Ayre

Blade tip:	370.5m	Observer height:	2m
DTM:	OS Terrain 50 DTM	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

Notes
World Ocean Base: OceanWise, Esri, GEBCO, Garmin, NaturalVue
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Figure 12.7

Figure Reference: OPEN.231864.00001.0008.0 Blade Tip ZTV

Figure 12.7: Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (2 of 5)

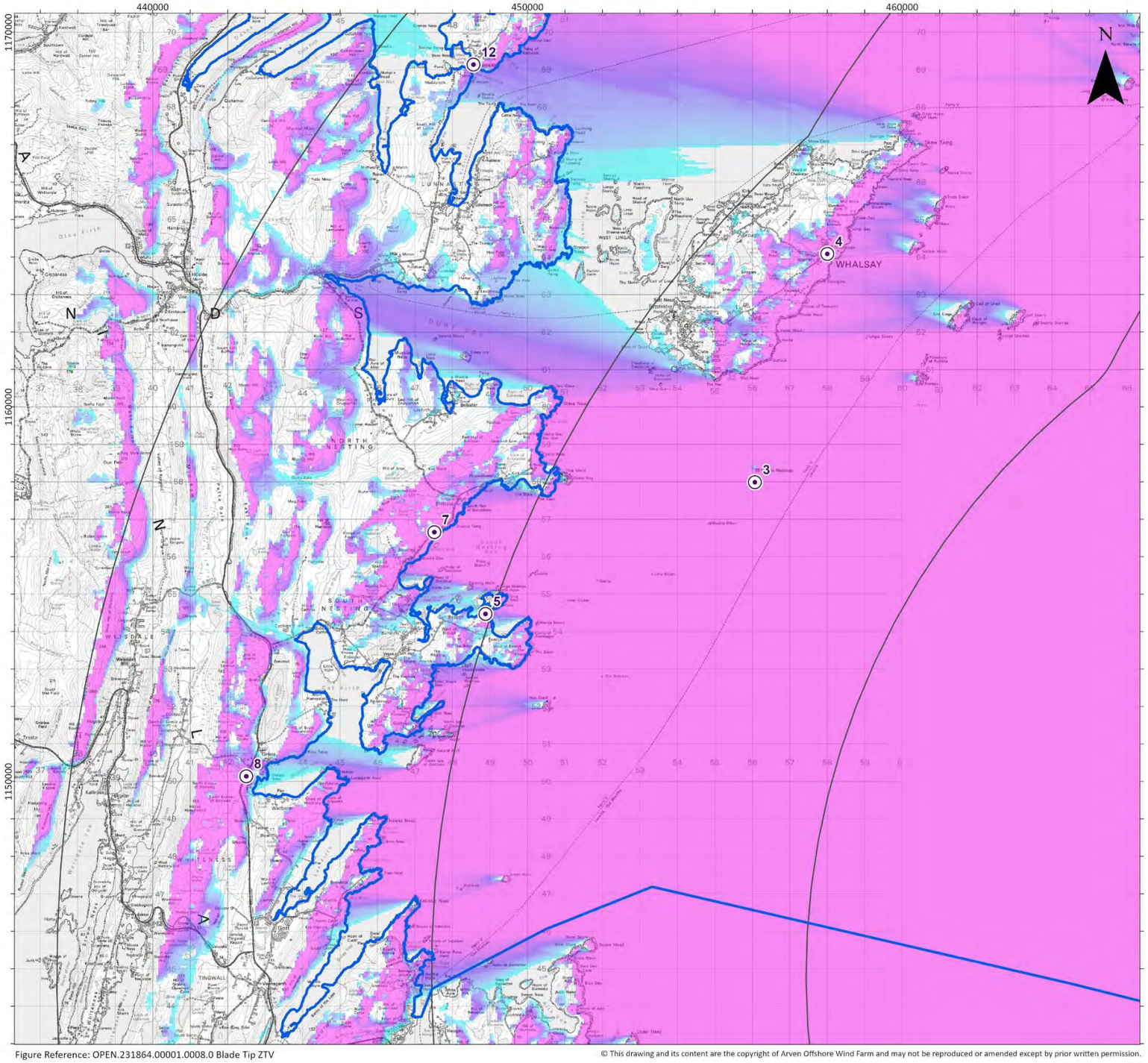

Figure Reference: OPEN.231864.00001.0008.0 Blade Tip ZTV

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Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (3 of 5)

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii

Zone of Theoretical Visibility
- High Visibility
- Low Visibility

Viewpoint
- 3. Lerwick to Bruray passenger ferry
- 4. Isbister and Nisthouse, Whalsay
- 5. Ling Ness headland
- 7. B9075, south of Brettabister
- 8. A970, south of Girlsta
- 12. Lunna House

Blade tip:	370.5m	Observer height:	2m
DTM:	OS Terrain 50 DTM	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

Notes
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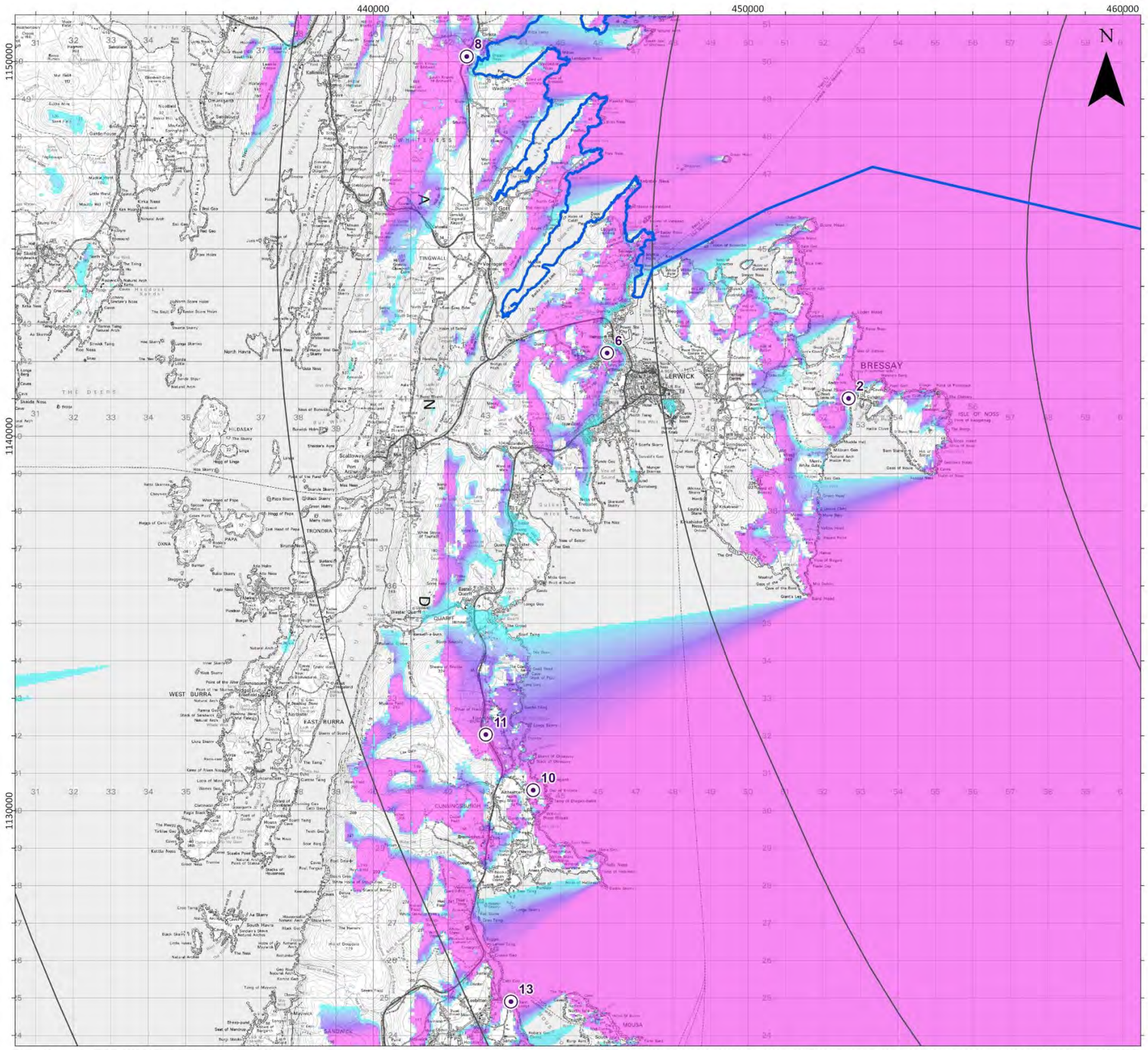
Figure 12.8

Figure 12.8: Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (3 of 5)



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Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (4 of 5)

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii

Zone of Theoretical Visibility
- High Visibility
- Low Visibility

Viewpoint
2. Bressay, Noss-sound
6. Lerwick, Staney Hill
8. A970, south of Girlsta
10. Aithsetter
11. A970, Fladabister
13. Sandwick

Blade tip:	370.5m	Observer height:	2m
DTM:	OS Terrain 50 DTM	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

Notes
World Ocean Base: OceanWise, Esri, GEBCO, Garmin, NaturalVue
Image:
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Coordinate System:
British National Grid

0 3.5 7 km
0 1 2 nm

Scale	Date	Drawn by	Checked by	Approved by
1:100,000 @ A3	13/03/2024	RA	CW	LT

Octagon Point,
5 Cheapside,
London,
United Kingdom
EC2V 6AA

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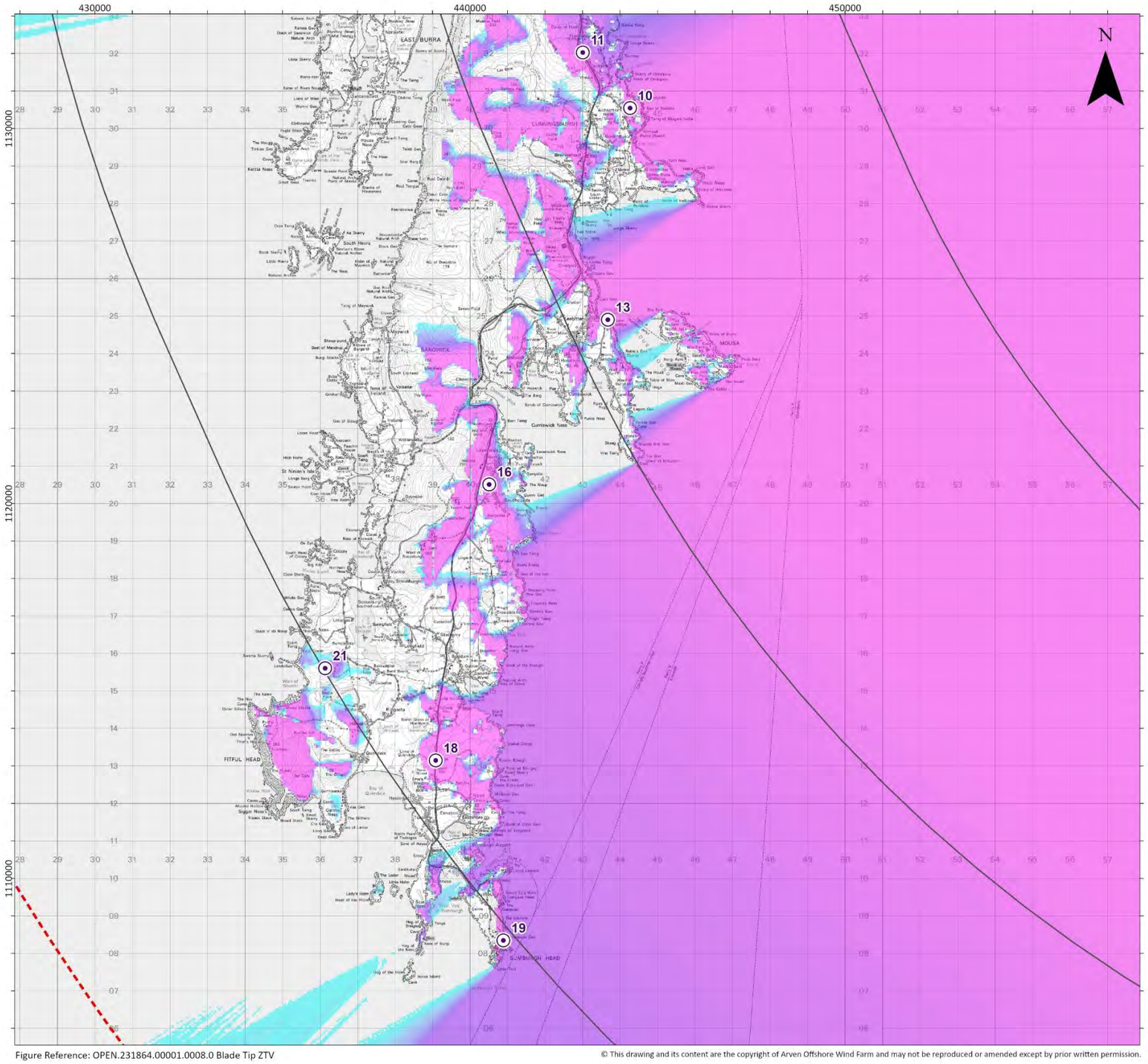
Figure 12.9

Figure Reference: OPEN.231864.00001.0008.0 Blade Tip ZTV

Figure 12.9: Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (4 of 5)



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Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (5 of 5)

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii

Zone of Theoretical Visibility
- High Visibility
- Low Visibility

Viewpoint
- 10. Aithsetter
- 11. A970, Fladabister
- 13. Sandwick
- 16. Levenwick
- 18. A970, north of Exnaboe
- 19. Sumburgh Head
- 21. Noss Hill, Mainland, west of Loch Spiggie

Blade tip:	370.5m	Observer height:	2m
DTM:	OS Terrain 50 DTM	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

Notes
World Ocean Base: OceanWise, Esri, GEBCO, Garmin, NaturalVue
Image:
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Coordinate System: British National Grid

0 3.5 7 km
0 1 2 nm

Scale	Date	Drawn by	Checked by	Approved by
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Figure 12.10

Figure Reference: OPEN.231864.00001.0008.0 Blade Tip ZTV

Figure 12.10: Large Scale Zone of Theoretical Visibility (Blade Tip) with Proposed Representative Viewpoints (5 of 5)

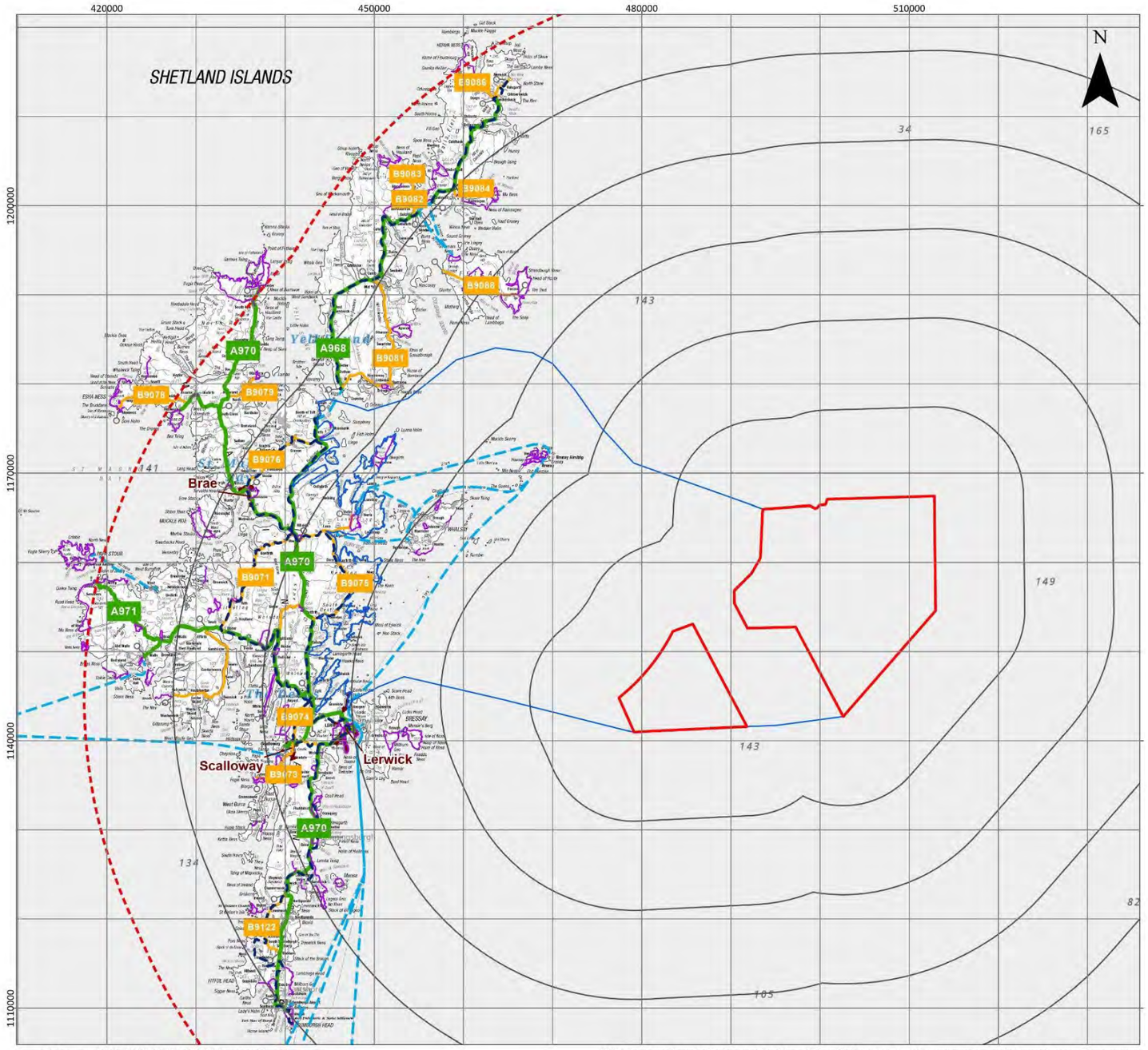

Figure Reference: OPEN.231864.00001.0010.0 Principle Visual Receptors

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Principal Visual Receptors

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- 60km Study Area
- 10km Radii
- Settlement
- Ferry Route
- A Road
- B Road
- National Cycle Route 1
- Core Paths

Notes

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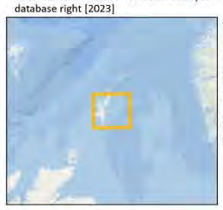

World Ocean Reference: Esri UK, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS
Image:
World Ocean Reference: Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
World Ocean Base: Esri, GEBCO, Garmin, NaturalVue

0 10 20 km
0 4 8 nm

Coordinate System: British National Grid

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Figure 12.11

Figure 12.11: Principal Visual Receptors

12.5.2 Preparation of visualisations

The following visualisations are proposed for agreed viewpoints in accordance with NatureScot (2017a) visualisation standards:

- Daytime baseline photographs and cumulative wirelines – 90 degree field of view (cylindrical projection) with further 90 degree field of view increments where necessary to illustrate cumulative developments.
- Wireline view to include a 53.5 degree field of view (planar projection) for viewpoints to be agreed.
- Daytime photomontage to include a 53.5 degree field of view (planar projection) for viewpoints to be agreed.
- Night time baseline photographs and wirelines – 90 degree field of view (cylindrical projection) for selected viewpoints to be agreed.
- Night time photomontage to include a 53.5 degree field of view (planar projection) for agreed selected viewpoints to be agreed.

12.6 Embedded Mitigation

As part of the initial design process, embedded mitigation measures are proposed to reduce the potential environmental effects of development. Measures related to SLVIA are as follows:

- C-2: Development of and adherence to a DSLP. The DSLP will confirm the layout and design parameters of the Project..
- C-5: Preparation of a Design Statement (DS). The DS will present representative wind farm visualisations from key viewpoints, based on the final layout and design specifications in the DSLP.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.

The requirement and feasibility of any mitigation measures will be consulted upon with relevant consultees throughout the EIA process.

12.7 Scoping of Impacts

12.7.1 Potential Impacts Scoped In

Table 12.3: Impacts scoped into the assessment of Seascape, Landscape and Visual Amenity

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction (and Decommissioning)			
Impact (daytime) of the construction of the Offshore Proposed Development on coastal character	Potential for short-term, temporary impacts on perceived seascape coastal character, arising as a result of the construction activities and structures that comprise the Offshore Proposed Development, which may alter the seascape character of the area within the Array areas themselves and the perceived character of the wider seascape through visibility of these changes.	Included in the landscape impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)
Impact (daytime) of the construction of the Offshore Proposed Development on perceived landscape character	Potential for short-term, temporary impacts on perceived landscape character, arising because of the construction activities and structures that comprise the Offshore Proposed Development, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character of the landscape.	Included in the landscape impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)
Impact (daytime) of the construction of the Offshore Proposed Development on perceived landscape character/special qualities of designated landscapes	Potential for short-term, temporary impacts on perceived landscape character and special qualities of designated landscapes, arising because of the construction activities and structures that comprise the Offshore Proposed Development, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character and qualities of the landscape.	Included in the landscape impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Impact (daytime) of the construction of the Offshore Proposed Development on visual receptors/ views	Potential for short-term, temporary impacts on views and visual amenity experienced by people from principal visual receptors and representative viewpoints, arising because of the construction activities and structures, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect views and visual amenity.	Included in the visual impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)
Operation and maintenance			
Impact (daytime) of the operation and maintenance of the Offshore Proposed Development on coastal character	Potential for significant effect. Long term, reversible effects on perceived seascape character, arising as a result of the operational wind turbines, substations and maintenance activities located within the Array Areas, which may alter the perceived character.	Included in the landscape impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)
Effects (daytime) of the operation and maintenance of the Offshore Proposed Development on perceived landscape character/special qualities of designated landscapes	Potential for significant effect. Long term, reversible effects on perceived landscape character of LCTs and qualities of designated landscapes, arising because of the operational wind turbines, substations, and maintenance activities, which will be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character and qualities of the landscape.	Included in the landscape impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)
Effects (daytime) of the operation and maintenance of the Offshore Proposed	Potential for significant effect. Long term, reversible effects on views and visual amenity experienced by people as principal visual receptors and representative viewpoints, arising because of the operational WTGs, potential offshore substations, and	Included in the visual impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Development on visual receptors/views	maintenance activities when visible from the coast during very good to excellent visibility conditions.		
Effects (daytime) of the operation and maintenance of the Offshore Proposed Development on views experienced by offshore visual receptors	Potential for significant effect. Long term, reversible effects on views and visual amenity experienced by offshore visual receptors, arising because of the operational WTGs, potential offshore substations, and maintenance activities when visible during very good to excellent visibility conditions.	Included in the visual impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)
Effects (night-time) of the operation and maintenance of the Offshore Proposed Development visible aviation lighting on visual receptors/ views	Potential for significant effect. Long term, reversible effects on views and visual amenity experienced by people from principal visual receptors and representative viewpoints arising because of the marine navigation and visible aviation lights.	Included in the visual impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)
Cumulative effect (daytime) of the operation of the Offshore Proposed Development on seascape coastal character, landscape character and views/ visual receptors	Potential for significant cumulative effect. Long term, reversible effects on perceived seascape character, landscape character of LCTs and qualities of designated landscapes, and views/visual amenity experienced by people arising as a result of visibility of the operational wind turbines, substations and maintenance activities located within the Offshore Proposed Development cumulatively with other proposed offshore windfarms located within the 60 km study area.	Included in cumulative landscape and visual impact assessment.	C-2 (DSLP), C-5 (DS), C-14 (DP)

12.7.2 Potential Impacts Scoped Out

Table 12.4: Impacts proposed to be scoped out of further assessment for SLVIA

Impact	Justification
Construction (and decommissioning)	
Construction phase seascape, landscape, and visual impacts of the Offshore Proposed Development outside the 60 km radius SLVIA study area (Figure 12.1).	The 60 km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 60 km due to the limited changes to views arising from the Offshore Proposed Development over such distances.
Impacts of the construction of the Offshore Proposed Development on physical aspects of landscape character.	Due to the location of the Offshore Proposed Development largely at a considerable distance offshore it will only impact on the perception of character and qualities – which is considered as an indirect effect in LVIA. No physical attributes that define landscape character or special qualities of designated landscapes will be changed because of the Offshore Proposed Development.
The seascape and landscape impacts of the Offshore Export Cable construction.	Limited influence on seascape and landscape, and receptors due to sporadic, temporary nature of above sea construction processes. The activities mainly occur from vessels, which are already an apparent component of the baseline seascape and landscape character. .
The visual impact of the Offshore Export Cable construction beyond 1km from Landfall	Limited influence on visual receptors beyond this distance due to sporadic, temporary nature of above sea construction processes. The activities mainly occur from vessels, which are already an apparent component of baseline views.
Impact of the Array Areas lighting on seascape coastal, landscape character and visual receptors at night during construction.	Navigational lights associated with construction buoyage and construction vessels will not be visible from the coast. Aviation marking lights may be required on top of cranes associated with heavy lift vessels or jack up vessels, however, these will be temporary in nature.
Impact of the Offshore Proposed Development construction on the Shetland NSA Special Qualities listed in section 12.4.3.1.	These Special Qualities would not be materially affected by the construction of the Offshore Proposed Development.

Impact	Justification
Impacts on the Ronas Hill and North Roe Wild Land Area.	The perceived wildness within this area would not be materially affected by the construction of the Offshore Proposed Development due to the 57.4 km distance to the Array Areas.
Impacts on Belmount House and Gardie House GDLs.	These GDLs would not be materially affected by the construction of the Offshore Proposed Development as the GDLs are not within the ZTV of the Array Areas.
Operation and maintenance	
Operation and maintenance phase seascape, landscape, and visual impacts of the offshore elements of the Offshore Proposed Development outside the 60 km radius SLVIA study area (Figure 12.1).	The 60 km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 60 km due to the limited changes to views arising from the Offshore Proposed Development over such considerable distance.
Impact of the aviation lighting on seascape coastal character and landscape character at night during operation and maintenance.	The matter of visible aviation lighting assessment will be assessed as wholly a visual matter as it is considered that the proposed aviation lighting will not have significant effects on the perception of landscape or seascape character, which is not readily perceived at night in darkness. No attributes of seascape or landscape character will be changed because of the lighting of the Project.
Impact of the Offshore Proposed Development on the Shetland NSA Special Qualities listed in section 12.4.3.1.	These Special Qualities would not be materially affected by the operation of the Offshore Proposed Development.
Impacts on the Ronas Hill and North Roe Wild Land Area.	The perceived wildness within this area would not be materially affected by the operation of the Offshore Proposed Development due to the 57.4km distance to the Array Areas.
Impacts on Belmount House and Gardie House GDLs.	These GDLs would not be materially affected by the operation of the Offshore Proposed Development as the GDLs are not within the ZTV of the Array Areas.

12.8 Potential Cumulative Impacts

Cumulative impacts will be considered as part of the EIA process. It is anticipated this would include onshore and offshore wind farms and a list of cumulative developments to be considered in the SLVIA will be agreed with NatureScot and Shetland Islands Council.

The assessment will consider the potential for significant cumulative impacts to arise as a result of the construction, operation and decommissioning of the Offshore Proposed Development, in the context of other developments that are either existing, consented/under construction, or at application stage.

The objective of the cumulative SLVIA is to describe, visually represent and assess the ways in which the Offshore Proposed Development will have additional effects when considered together with other existing, consented or application stage developments of a similar nature and to identify related significant cumulative effects arising. In accordance with NatureScot (2021) guidance '*The key principle for all impact assessments is to focus on the likely significant impacts and those which are likely to influence the outcome of the consenting process.*' With regard to cumulative LVIA NatureScot (2021) advises that it '*will only seek cumulative impact assessments where we consider that a proposal could result in significant cumulative impacts which could affect the eventual planning decision.*'

Therefore, the cumulative SLVIA will focus on the likely significant effects and in particular on those which are likely to influence the outcome of the consenting process.

Existing and under construction energy development will form part of the baseline and the addition of the Offshore Proposed Development to this will be part of the main assessment.

The EIAR will include a section on the inter-relationship between the effects of the Offshore Proposed Development and the Onshore Transmission Infrastructure where the same receptors may be affected.

12.9 Potential Transboundary Impacts

Due to the relatively concentrated nature of any potential impacts on the seascape, landscape, and visual resource to the UK coastline within the 60 km SLVIA study area, transboundary impacts are unlikely to occur on seascape, landscape, or visual receptors. Therefore, transboundary impacts will be scoped out from further consideration within the SLVIA.

12.10 Proposed Approach to EIA

12.10.1 Relevant Guidance

The assessment will be undertaken in accordance with the methods outlined in the following good practice guidance documents:

- Landscape Institute with the Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment. Third Edition.
- Landscape Institute (2019). Visual Representation of Development Proposals Technical Guidance Note 06/19.

- Landscape Institute (2021). Assessing landscape value outside national designations.
- NatureScot (2021). Assessing the Cumulative Impact of Onshore Wind Energy Developments.
- NatureScot (2017). Visual Representation of Windfarms: Guidance, Version 2.2.
- NatureScot (2017). Siting and Designing Windfarms in the Landscape, Guidance (Version 3a).
- NatureScot (2018). Guidance note Coastal Character Assessment.
- Scottish Government (2022). Guidance for applicants on using the design envelope for applications under Section 36 of the Electricity Act 1989.
- Scottish Government (2018). Offshore wind, wave and tidal energy applications: consenting and licensing manual.

12.10.2 Anticipated Additional Data Sources at EIA

The SLVIA will be informed by desk-based studies and field survey work undertaken within the SLVIA study area. The landscape, seascape and visual baseline will be informed by desk-based review of landscape and seascape character assessments, and the ZTV, to identify receptors that may be affected by the Offshore Proposed Development and produce written descriptions of their key characteristics and sensitivity.

A preliminary desk-based assessment will be undertaken of seascape, landscape and visual receptors using ZTV analysis, to identify which landscape and visual receptors are unlikely to be significantly affected, which will be subject to a simple assessment, and those that are more likely to be significantly affected by the Offshore Proposed Development, which require a detailed assessment.

Interactions will be identified between the Offshore Proposed Development and seascape, landscape, and visual receptors, to predict potentially significant effects arising and measures may be proposed to mitigate effects.

For those receptors where a detailed assessment is required, primary data acquisition will be undertaken through a series of surveys. These surveys will include field survey verification of the ZTV from CCTs/LCTs, micro-siting of viewpoint locations, panoramic baseline photography and visual assessment survey from all representative viewpoints (as listed in Table 12.2).

Visual assessment surveys will be undertaken in the field based on a review of visualisations at representative viewpoints. Sea-based offshore surveys are not proposed to be undertaken as part of the SLVIA. Illustrative wirelines (without baseline photography) will be prepared for offshore viewpoints (e.g., from commercial ferry routes) if required.

Assessment of the sensitivity of seascape, landscape and visual receptors will be undertaken, together with an assessment of the magnitude of change arising as a result of the Offshore Proposed Development. Judgements on sensitivity and magnitude will be combined to arrive at an overall assessment as to whether the Offshore Proposed Development will have an effect that is significant or not significant on each seascape, landscape, and visual receptor.

The SLVIA undertaken as part of the EIA will prepare the necessary information to assess the night-time visual effects of the proposed lighting of the Offshore Proposed Development.

12.10.3 Assessment Methodology

The objective of the assessment of the Offshore Proposed Development will be to predict the likely significant effects on the seascape, landscape, and visual resource. In accordance with the EIA Regulations, the SLVIA effects will be assessed to be either significant or not significant. The methodology to undertake the SLVIA will reflect the 'Guidelines for Landscape and Visual Impact Assessment: Third Edition' (Landscape Institute, 2013).

Consideration of the Offshore Proposed Development and potential seascape, landscape and visual impacts is based on a 'Design Envelope' approach following the Scottish Government (2022) 'Guidance for applicants on using the design envelope for applications under Section 36 of the Electricity Act 1989'. A Design Envelope assessment approach is used in the SLVIA due to the uncertainty of the detail of the final design due to the nature of the Offshore Proposed Development and evolving technology.

In accordance with guidance the SLVIA will:

- Be undertaken on the basis of the relevant design parameters applicable to the characteristics of the Offshore Proposed Development included in the application documents; and
- For each of the different receptors, establish those parameters likely to result in the maximum adverse effect (the 'worst-case scenario') and be undertaken accordingly to determine significance.

The SLVIA will assess the effects of changes resulting from the Offshore Proposed Development on the seascape and landscape as a resource, the views available to people and their visual amenity. The SLVIA will be undertaken using the following steps:

- The features of the Offshore Proposed Development that may result in seascape, landscape and visual effects will be described. The overall scope of the assessment will be defined, including the SLVIA study area and range of possible seascape, landscape, and visual effects.
- The seascape/landscape baseline will be established using seascape / landscape character assessment and the ZTV of the WTGs within the Array Areas, to identify seascape and landscape receptors that may be affected and their key characteristics and value.
- The visual baseline will be established by identifying the ZTV, identifying the people who may be affected and identifying visual receptors and selecting representative viewpoints.
- A preliminary or 'simple' assessment will be undertaken of seascape, landscape and visual receptors using desk-based information, wirelines and ZTV analysis, to identify which seascape, landscape and visual receptors are unlikely to be significantly affected and can be scoped out of the assessment (in consultation with relevant stakeholders) and those that are more likely to be significantly affected by the Offshore Proposed Development, which require to be assessed in full.
- Interactions are identified between the Offshore Proposed Development and seascape, landscape, and visual receptors, to predict likely significant effects arising and measures that are proposed to mitigate effects.
- An assessment of the susceptibility of seascape, landscape and visual receptors to the specific change and the value attached to the seascape, landscape and visual resource will be undertaken, combining these judgements to assess the sensitivity of the seascape, landscape and visual receptors to the Offshore Proposed Development.
- An assessment of the size / scale of seascape / landscape impact, the degree to which seascape / landscape elements are altered and the extent to which the impacts change the key characteristics of the seascape / landscape will be undertaken, combining these judgements to assess the magnitude of change on each seascape / landscape receptor.

- An assessment of the size / scale of visual impact, the extent to which the change would affect views, whether this is unique or representative of a wider area, and the position of the Offshore Proposed Development in relation to the principal orientation of the view and activity of the receptor will be undertaken. These judgements are combined to assess the magnitude of change on the visual receptor.
- The assessments of sensitivity to change and magnitude of change will be combined to assess the significance of seascape, landscape, and visual effects.

The significance of effects will be assessed through a combination of two considerations – the sensitivity of the landscape or visual receptor / view and the magnitude of change that will result from the Offshore Proposed Development. In accordance with GLVIA3 (Landscape Institute, 2013), the SLVIA methodology requires the application of professional judgement, but generally, the higher the sensitivity and the higher the magnitude of change the more likely that a significant effect will arise.

The objective of the cumulative SLVIA is to describe, visually represent and assess the ways in which the Offshore Proposed Development will have additional effects when considered together with other existing, consented or application stage developments and to identify related significant cumulative effects arising. The guiding principle in preparing the cumulative SLVIA will be to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process.

12.11 Scoping Questions

The following scoping questions refer to the seascape, landscape, and visual amenity chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those data listed in Section 12.3, and any additional anticipated data listed in Section 12.10.2, being used to inform the Offshore EIA?
- Do you agree that all receptors related to seascape, landscape, and visual amenity have been identified?
- Do you agree with the proposed study areas identified for the seascape, landscape and visual amenity receptors?
- Do you agree with the scoping in and out of impacts related to seascape, landscape, and visual amenity as set out in Section 12.7?
- Do you agree with the proposed approach to assessment of transboundary effects related to seascape, landscape, and visual amenity?
- Do you agree with the proposed approach assessment of cumulative effects related to seascape, landscape, and visual amenity?
- Do you agree with the proposed assessment methodology related to seascape, landscape, and visual amenity?
- Do consultees agree with the proposed list of representative viewpoints identified in Table 12.2 and shown on Figure 12.5 to 12.10?
- Do consultees agree with the approach to the assessment of visible aviation lighting and the proposed night-time viewpoints identified in Table 12.2?

13 Commercial Fisheries

13.1 Introduction

This chapter of the Offshore Scoping Report considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Offshore Proposed Development on commercial fisheries. This chapter provides an overview of the existing environment and sets out the proposed methodology and approach to assessing effects on commercial fisheries receptors in the EIAR.

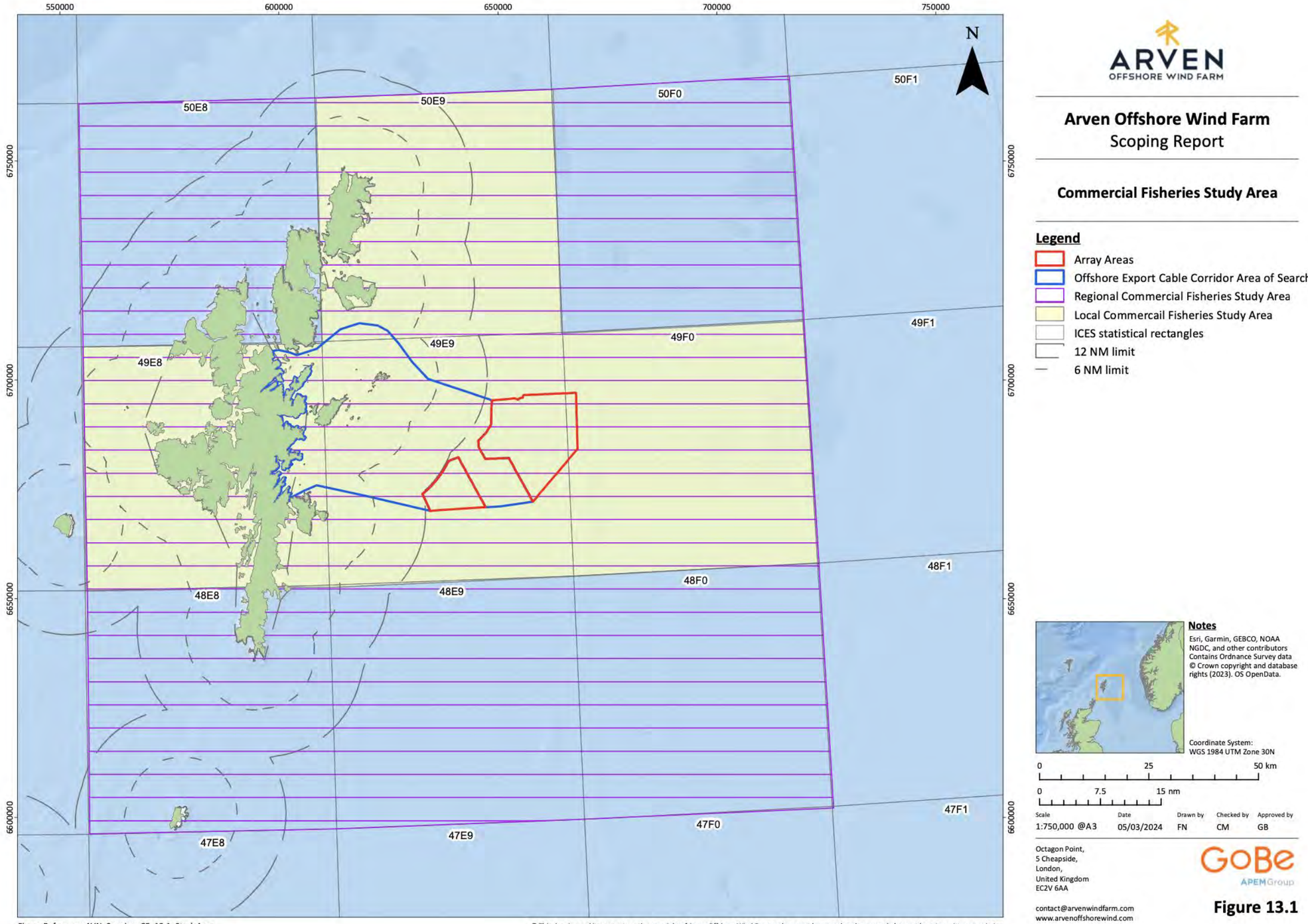
For the purpose of this Offshore Scoping Report, 'commercial fishing' is defined as any form of fishing activity legally undertaken where the catch is sold for taxable profit.

This chapter has been prepared by NiMa Consultants Limited.

13.2 Study Area

The Offshore Proposed Development consists of the Array Areas and the OfECC which will be refined and routed within the Scoping Boundary (Figure 13.1). The Offshore Proposed Development is located within the central western portion of the ICES Division 4a (north North Sea) statistical area; within UK EEZ waters. For the purpose of recording commercial fisheries landings, ICES Division 4a is divided into statistical rectangles, of which the Array Areas overlap with 49E9 and 49F0 and the OfECC within the Scoping Boundary overlaps with 49E9, 49E8 and 50E9. For the purposes of this Offshore Scoping Report, the commercial fisheries Local study area comprises these overlapping ICES rectangles: 49E8, 49E9, 49F0 and 50E9.

While the Local study area focuses on the Offshore Proposed Development overlap with ICES rectangles, a wider regional area will be considered for displacement impacts within the EIAR. It is proposed that the Regional study area includes an additional five ICES rectangles immediately adjacent to the Local study area, as indicated in Figure 13.1.



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Commercial Fisheries Study Area

Legend
- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- Local Commercail Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Notes
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Coordinate System:
WGS 1984 UTM Zone 30N

0 25 50 km
0 7.5 15 nm

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Figure 13.1

Figure 13.1: Commercial Fisheries Study Areas

13.3 Data Sources at Scoping

Table 13.1 sets out the information and data sources which have been considered in the preparation of this chapter, and will be considered within the EIAR assessment where relevant matters are scoped in.

Table 13.1: Summary of Key Data and Information Sources for Commercial Fisheries

Dataset	Year(s)	Description
UK annual fisheries landings statistics **(MMO, 2023a, 2018)**	2018 to 2022 2011 to 2017	Fisheries landings data for registered fishing vessels landing to their home nation ports. The most recent data has been presented in this Offshore Scoping Report but longer term datasets will be analysed within the Offshore Proposed Development EIAR.
UK Vessel Monitoring System (VMS) data **(MMO, 2023b)**	2016 to 2020	VMS data for fishing vessels greater than 15 m in length. UK vessels ≥12 m in length have VMS on board, however, to date, the MMO provides amalgamated VMS datasets for ≥15 m vessels only. VMS data sourced from MMO displays the first sales value (£) of catches. The most recent data has been presented in this Offshore Scoping Report, but longer term datasets will be analysed within the Offshore Proposed Development EIAR.
EU annual fisheries landings statistics **Scientific, Technical and Economic Committee for Fisheries (STECF), (EU DCF, 2020)**	2004 to 2016	Fisheries landings data for registered fishing vessels landing to their home nation ports.
EU VMS data **(ICES, 2022)**	2016 to 2020	VMS data for fishing vessels greater than 12 m in length. VMS data sourced from ICES displays the surface swept area ratio of catches by different gear types and covers EU (including UK) registered vessels 12 m and over in length. Surface swept area ratio indicates the number of times in an annual period that a demersal fishing gear makes contact with (or sweeps) the seabed surface. Surface swept area ratio provides a proxy for fishing intensity.

Dataset	Year(s)	Description
Fisheries datasets		
Marine Scotland NMPi, various publication dates (Marine Scotland MAPS NMPI, 2023)	Various temporal coverage	Fisheries datasets available from the Marine Scotland MAPS NMPi, including ScotMap data and heatmaps for activity by small fishing boats (<12 m in length).
Fishing vessel route density data **European Maritime Safety Agency (EMSA, 2023)**	2020	Fishing vessel route density, based on vessel Automatic Identification System (AIS) positional data. AIS is required to be fitted on fishing vessels ≥15 m length. The most recent data has been presented in this Offshore Scoping Report, but longer term datasets will be analysed within the Offshore Proposed Development' EIAR.
Sectoral Marine Plan **(Scottish Government, 2020)**	2019 to 2022	Description of regional commercial fisheries activity.
ICES stock assessments	2022 to 2023	Stock assessment reporting for various species, including species managed via a Total Allowable Catch (TAC) such as mackerel, herring, cod, haddock and whiting.
UHI Shetland and Marine Directorate stock assessments	Various temporal coverage	Stock assessment reporting for various species, including non-quota species of scallop, brown crab, velvet crab and lobster.
Project-specific marine traffic survey data	September and October 2023	Data gathered during a non-dedicated marine traffic survey, piggybacked on to the Arven benthic ecology survey undertaken in 2023. Additional marine traffic survey data will be gathered to inform EIA.
Project-specific Fisheries Liaison Officer (FLO) records	September and October 2023	FLO observations of fishing vessels gathered during a non-dedicated marine traffic survey, piggybacked on to the Arven benthic ecology survey undertaken in 2023. Additional FLO data will be gathered to inform EIA.

It should be noted that the quantitative datasets identified in Table 13.1 may not capture all commercial fisheries activity in the commercial fisheries study areas. For instance, the VMS datasets only covers vessels ≥12 m (ICES data) or ≥15 m (MMO data) in length. Note that UK vessels ≥12 m in length have VMS on board, however, to date, the MMO provides amalgamated VMS datasets for ≥15 m vessels only.

However, in addition to VMS data, other published data does provide a useful insight into commercial fisheries activity undertaken in inshore areas and by smaller vessels not captured by VMS data (e.g., Marine Directorate inshore mapping for vessels under 12 m, and ScotMap inshore fisheries mapping and heatmaps for small fishing boats, <12 m in length) and will be utilised where appropriate. Consultation with fisheries stakeholders and industry is expected to further inform assessment in the EIAR.

Consultation with representatives of fishermen's associations and organisations will be undertaken to seek to corroborate the findings of desk-based baseline data analysis and to provide insight into specific fishing grounds and activity of any vessels active in the area. Consultation will also be important to inform gear specifications for vessels active in the area, which will allow a full understanding of how different vessels and different gear configurations may be affected.

Variations and trends in commercial fisheries activity are an important aspect of the baseline assessment and is the principal reason for considering up to five years of key baseline data, and longer timeseries where possible. Available landings data spans the period of the COVID-19 pandemic, which is understood to have temporarily affected market demand and supply chains. Furthermore, changes in fishing patterns resulting from the withdrawal of the UK from the EU would also be reflected in data sets for 2021 onwards. Long term environmental and climatic changes may be expected to be detectable within the five-year time series but may benefit from longer-term analysis dependent on the target species. Inclusion of such longer-term analysis will be informed by stakeholder consultation.

13.4 Baseline Environment

13.4.1 Commercial Fisheries in the Local and Regional Study Areas

An understanding of the commercial fisheries baseline environment within the study areas has been developed from utilisation of the available literature and data sources presented in Table 13.1. This section includes a description of the commercial fish targeted by vessels registered in the UK, Norway, Sweden, Denmark and Ireland and landed into UK ports (for all vessels) and non-UK ports (for UK vessels only).

13.4.1.1 Local Study Area

Landings from the commercial fisheries Local study areas had an annual average landings value of approximately £84.9 million across the years 2018 to 2022 (MMO, 2023a), with landings values peaking in 2018 at £107.6 million and being at their lowest in 2022 at £76.8 million (likely linked to total allowable catches (TAC)). Over the same time period, the annual average weight of landings from the Local study area was 66,000 tonnes, peaking at approximately 93,000 tonnes in 2018. The value and quantity landed from the Local study area indicates extremely high value fisheries.

Landings of pelagic species dominated the catch from the Local study area, accounting for 68% of the total landed value and 83% of landed weight (based on 2018-2022 data from MMO, 2023a). Landings of demersal fish species accounted for 26% of the total landed value (and 15% of the weight), and shellfish species for 6% (and 3% of the weight). Scottish vessels were responsible for the majority (89%) of landings by value, with landings also being made by vessels registered in England and to a much lesser extent vessels registered in Northern Ireland, France, Norway, Denmark and Ireland. The main landing ports for catches from the Offshore Proposed Development include (but are not limited to) Lerwick and Peterhead. Pelagic catches are also landed by UK vessels into Norwegian ports, including Ellingsoy, Selje and Alesund.

Figure 13.2 and Figure 13.3 show the top 12 species landed from the commercial fisheries Local study area by value and weight respectively, from 2018 to 2022 (MMO, 2023a). Figure 13.4 shows the landed value over the same period from the Local study area by nation of vessel registration and gear type. The key species landed are mackerel (*Scombrus scombrus)*, cod (*Gadus morhua)*, herring (*Clupea harengus)*, haddock (*Melanogrammus aeglefinus)* and whiting (*Merlangius merlangus)*.

Mackerel are by far the highest value fishery in the Local study area, with an average of £53 million landed annually. The fishery is highly seasonal, operating in this area during October and November.

Landing trends per month will be analysed within the EIAR for individual species at both an ICES rectangle level, and by port of landing to identify which fleets and fisheries operate at specific times of the year.

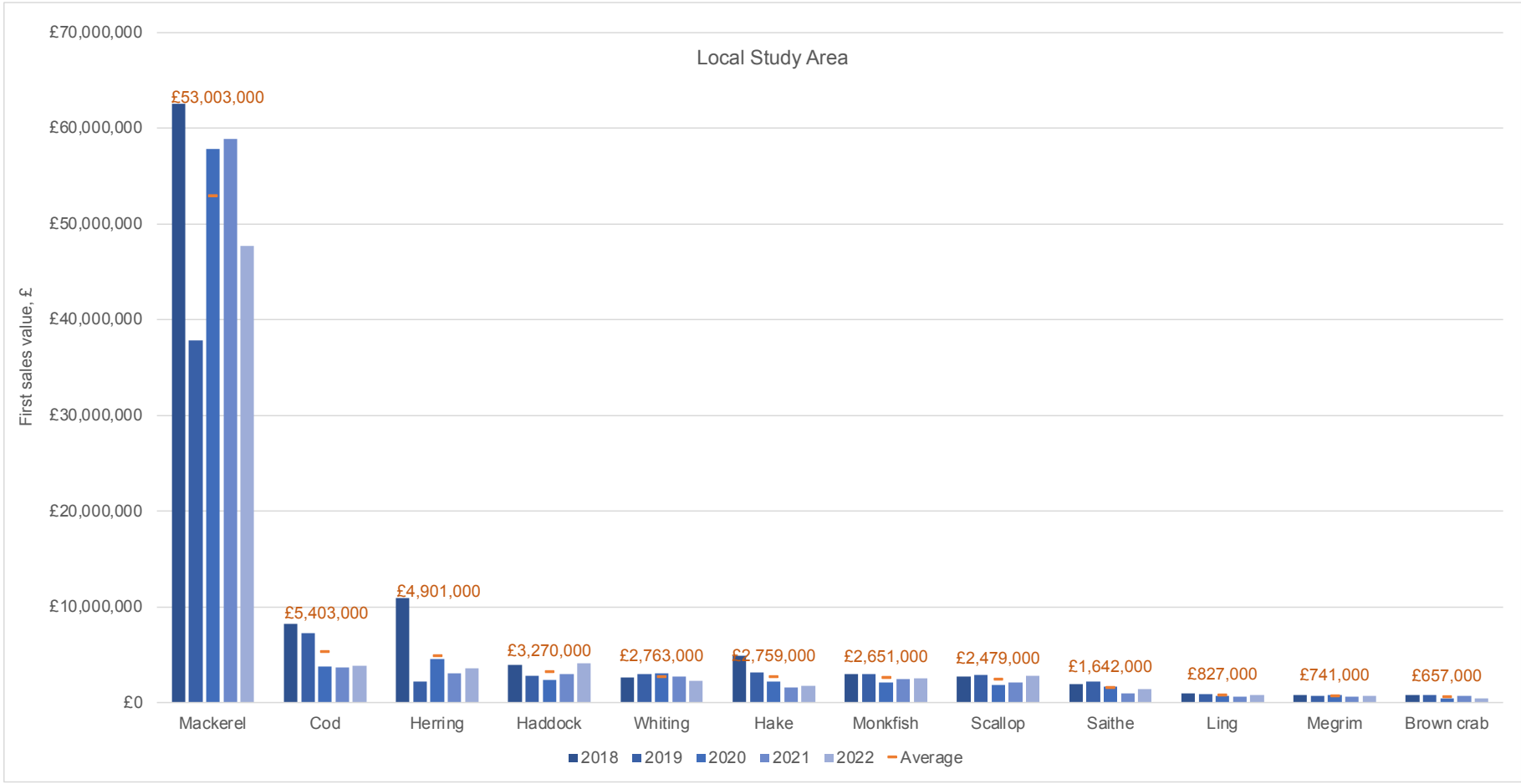


Figure 13.2: Top twelve species by value (first sales in Great British Pound (GBP)) from 2018 to 2022 landed from the commercial fisheries Local Study Area for vessels registered in UK, Norway, Sweden, Denmark and Ireland, landing into UK ports (data source: MMO, 2023a)

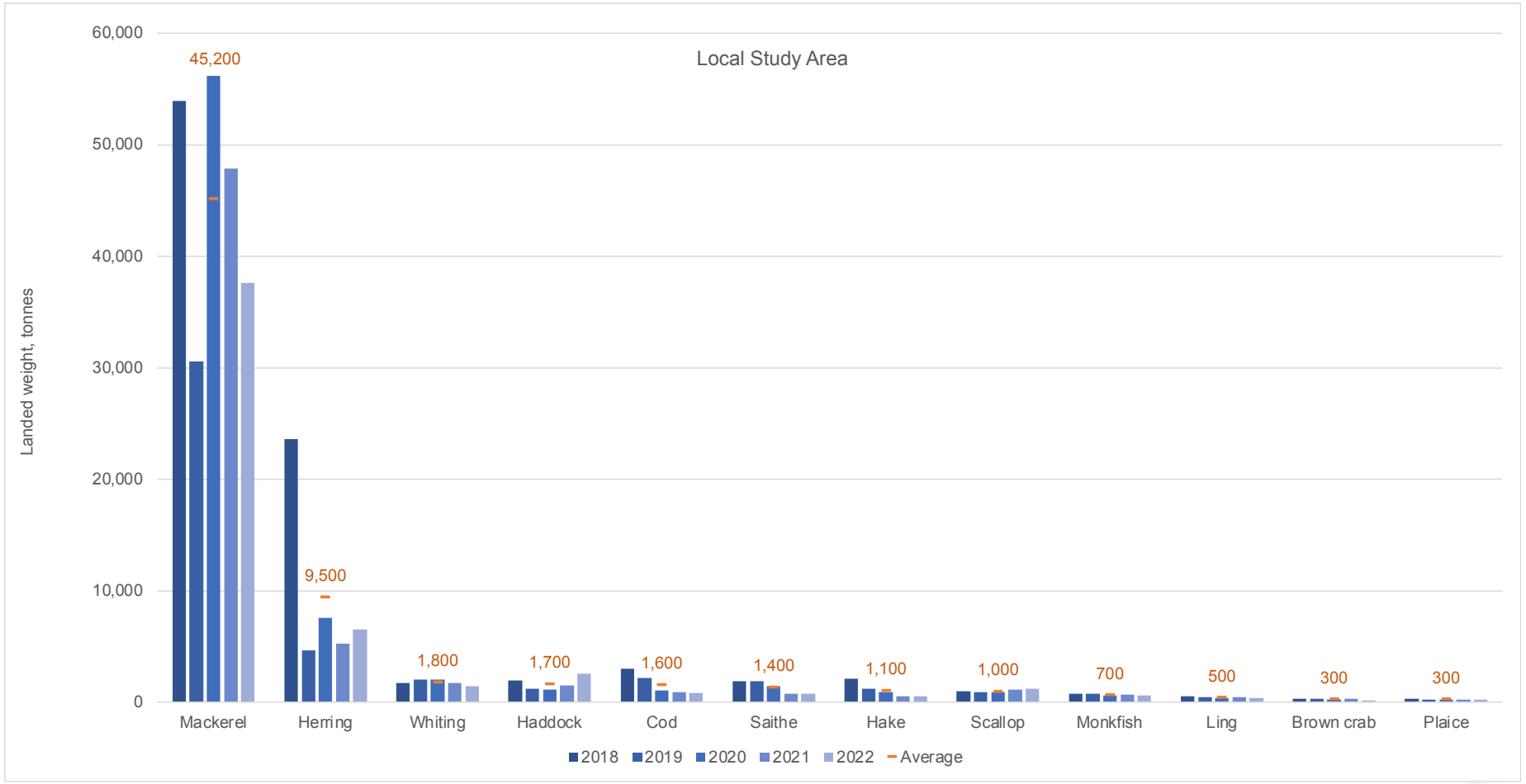


Figure 13.3: Top twelve species by weight (tonnes) from 2018 to 2022 landed from the commercial fisheries Local Study Area for vessels registered in UK, Norway, Sweden, Denmark and Ireland, landing into UK ports (data source: MMO, 2023a)

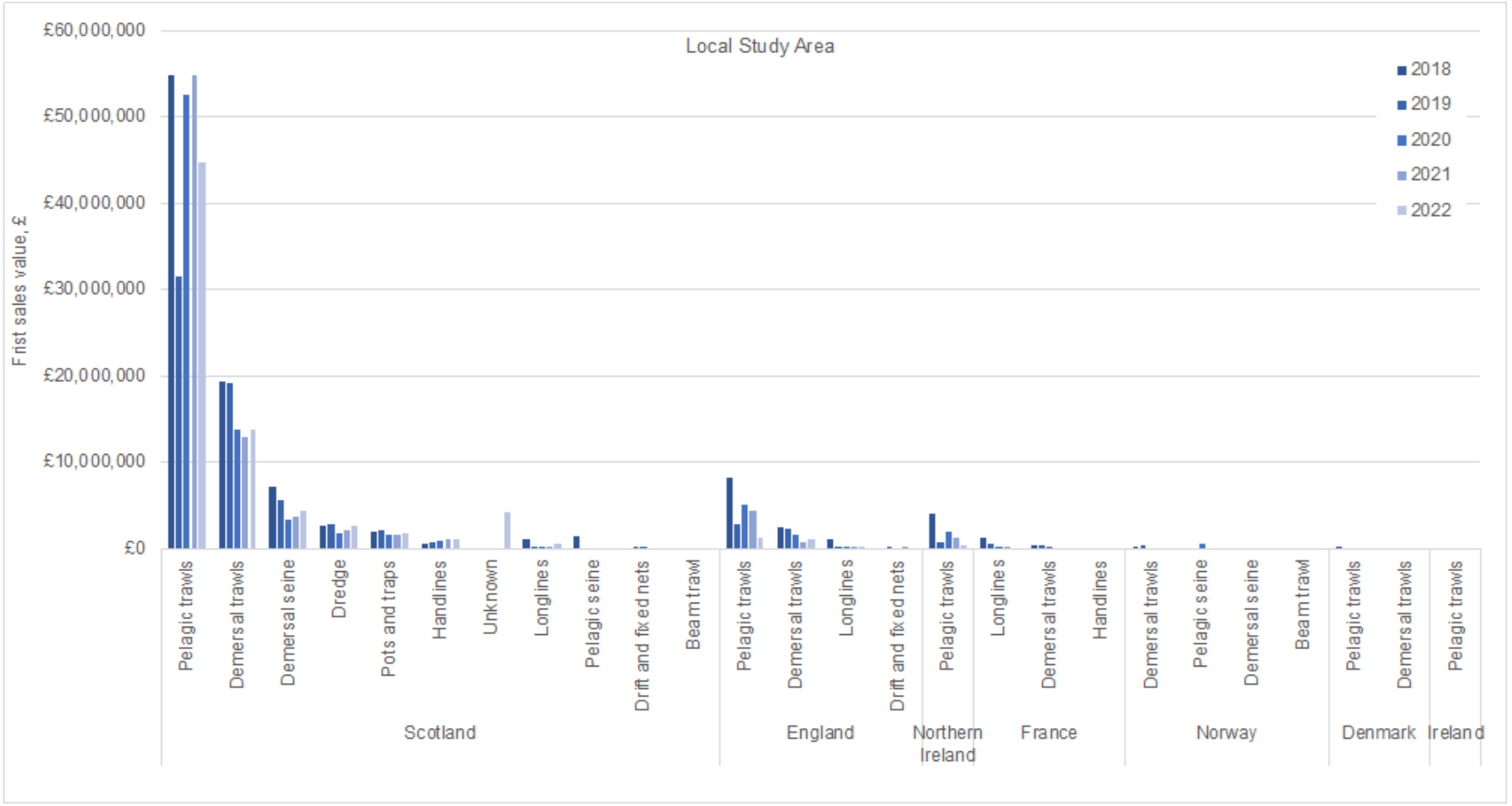


Figure 13.4: Average landed value from (2018 to 2022 (first sales in GBP) from the commercial fisheries Local Study Area by nation and gear type for vessels registered in UK, Norway, Sweden, Denmark and Ireland, landing into UK ports (data source: MMO, 2023a)

13.4.1.2 Regional Study Area

Landings data for the Regional study area (shown in Figure 13.5, Figure 13.6 and Figure 13.7) indicate a similar species profile as the Local study area. Annually £87.8 million of mackerel are landed from the Regional study area; £11.8 million of herring and £11 million of cod.

Landings data for non-UK vessels catching in the Regional study area and landing into UK ports indicates the potential for fishing activity by Norwegian, French, Danish and Irish vessels deploying pelagic trawl, purse seine and long lines.

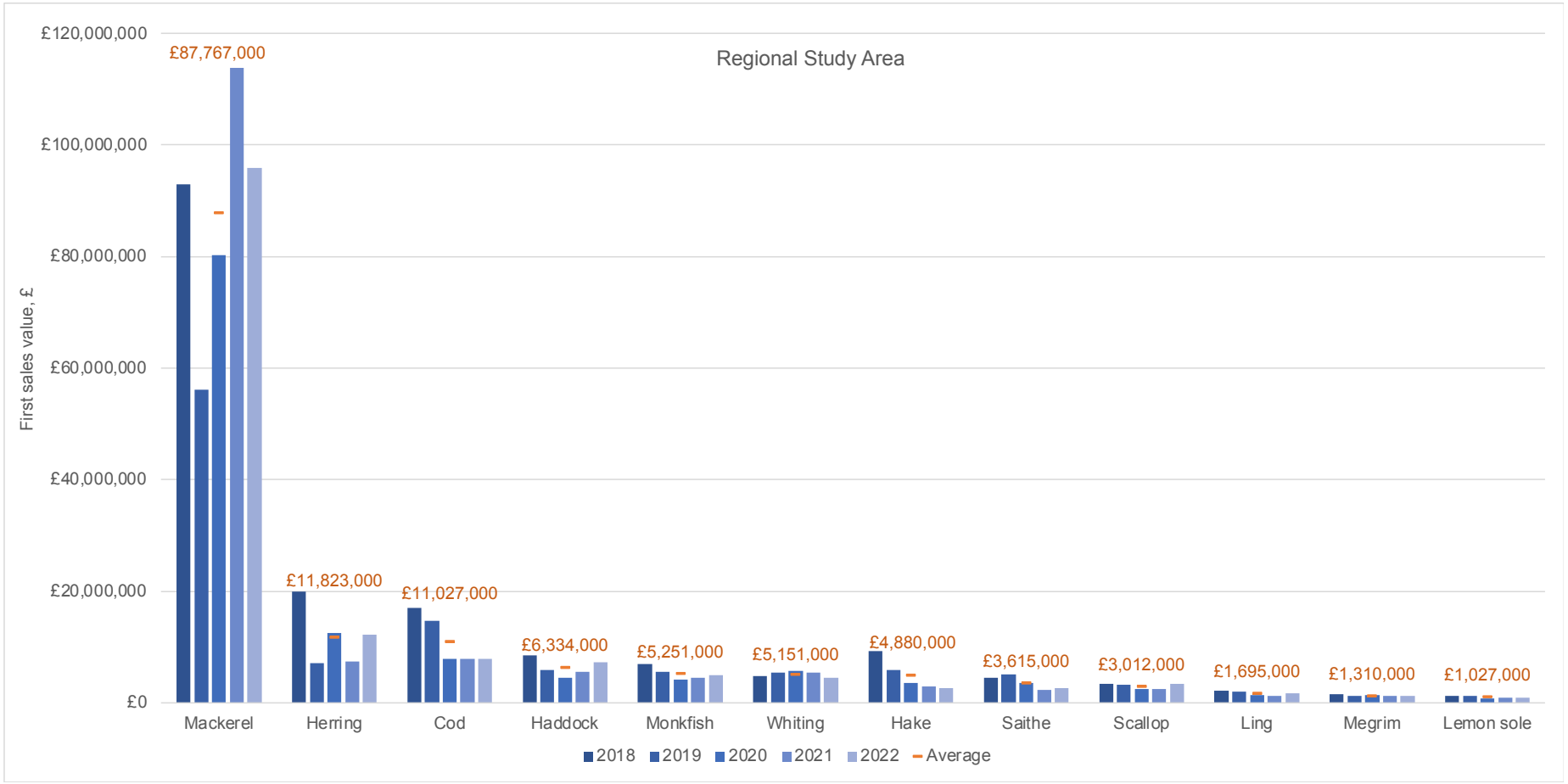


Figure 13.5: Top twelve species by value (first sales in Great British Pound (GBP)) from 2018 to 2022 landed from the commercial fisheries Regional Study Area for vessels registered in UK, Norway, Sweden, Denmark and Ireland, landing into UK ports (data source: MMO, 2023a)

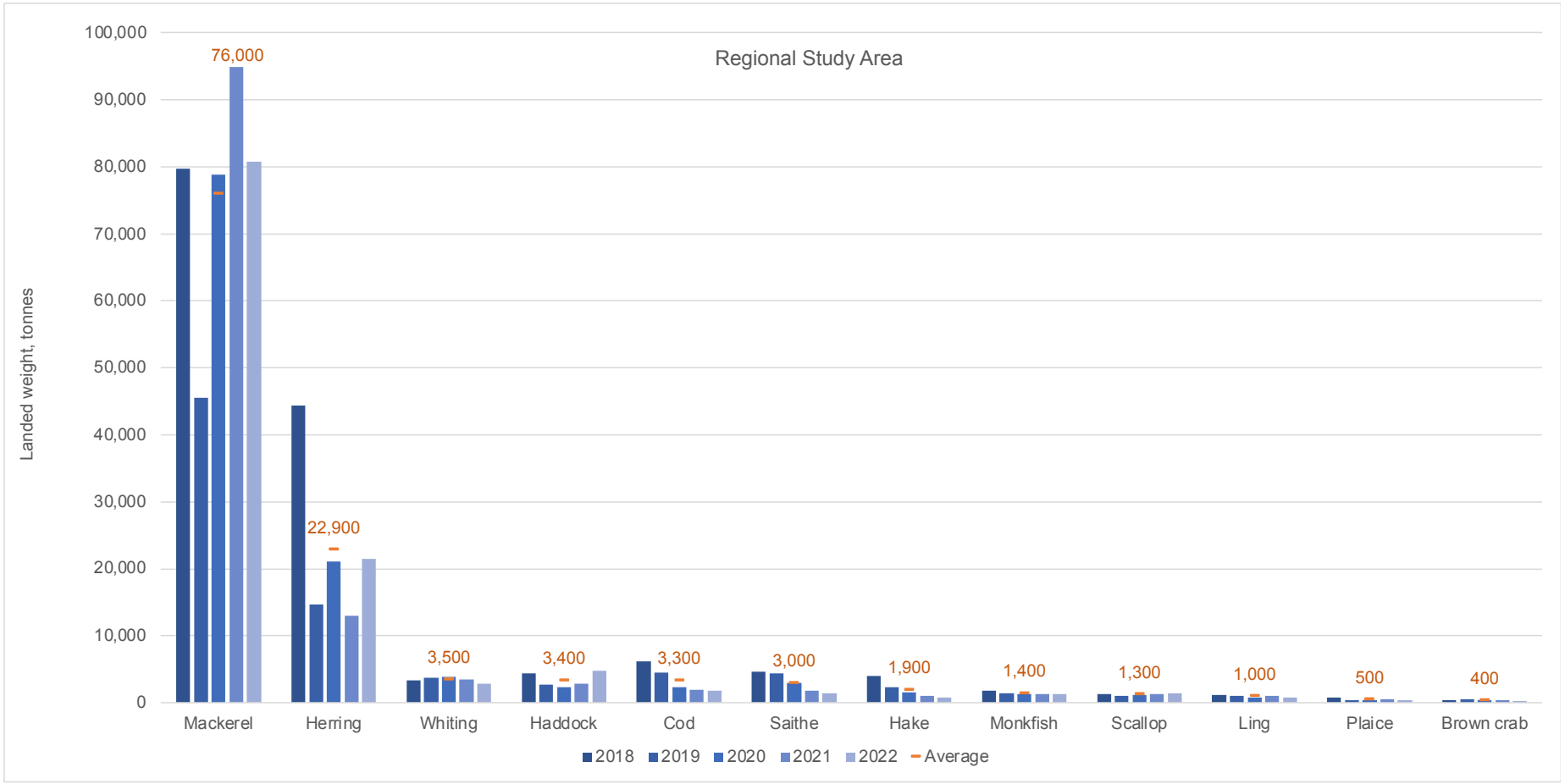


Figure 13.6: Top twelve species by weight (tonnes) from 2018 to 2022 landed from the commercial fisheries Regional Study Area for vessels registered in UK, Norway, Sweden, Denmark and Ireland, landing into UK ports (data source: MMO, 2023a)

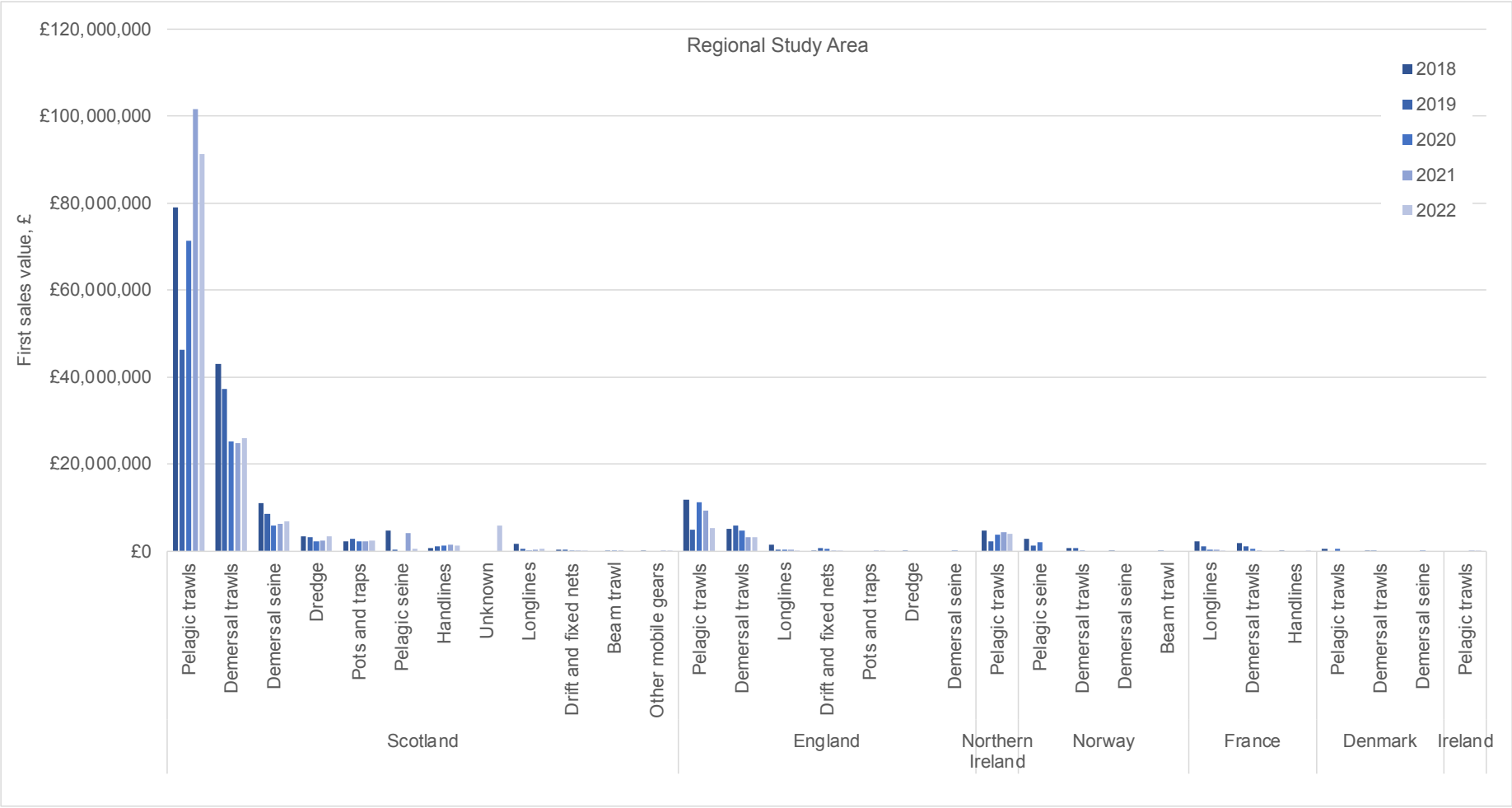


Figure 13.7: Average landed value from (2018 to 2022 (first sales in GBP) from the commercial fisheries Regional Study Area by nation and gear type for vessels registered in UK, Norway, Sweden, Denmark and Ireland, landing into UK ports (data source: MMO, 2023a)

13.4.1.3 Spatial Activity

In addition to landings data, spatial data describing fishing activity is available, including AIS fishing vessel route density data. AIS is required to be fitted on fishing vessels ≥15 m length. The data presented in Figure 13.8 is specific to fishing vessels and indicates the route density per square kilometre during 2022. This data does not distinguish between transiting vessels and active fishing but does provide a useful source to corroborate fishing grounds. Data indicates high levels of fishing vessel presence within the Offshore Proposed Development Local and Regional study areas, and within the Scoping Boundary. Fishing vessel activity is noted within the 6 NM boundary with what appear to be transiting routes to and from fishing grounds. Other fishing vessel activity is noted across the Scoping Boundary and within the Array Areas that appears to be active fishing.

VMS and spatial data to map fishing activity is available for UK and EU fleets. VMS data sourced from ICES displays the surface swept area ratio of catches by different gear types and covers EU (including UK) registered vessels 12 m and over in length. Surface swept area ratio indicates the number of times in an annual period that demersal fishing gear makes contact with (or sweeps) the seabed surface. Surface swept area ratio provides a proxy for fishing intensity and has been analysed to determine an average annual swept area ratio based on data from 2016 to 2020. Figure 13.9 presents demersal otter trawl fishing activity within the Regional study area. Fishing grounds are identified inside 6 NM in the north of the Scoping Boundary, at the 12 NM boundary and within the Array Areas.

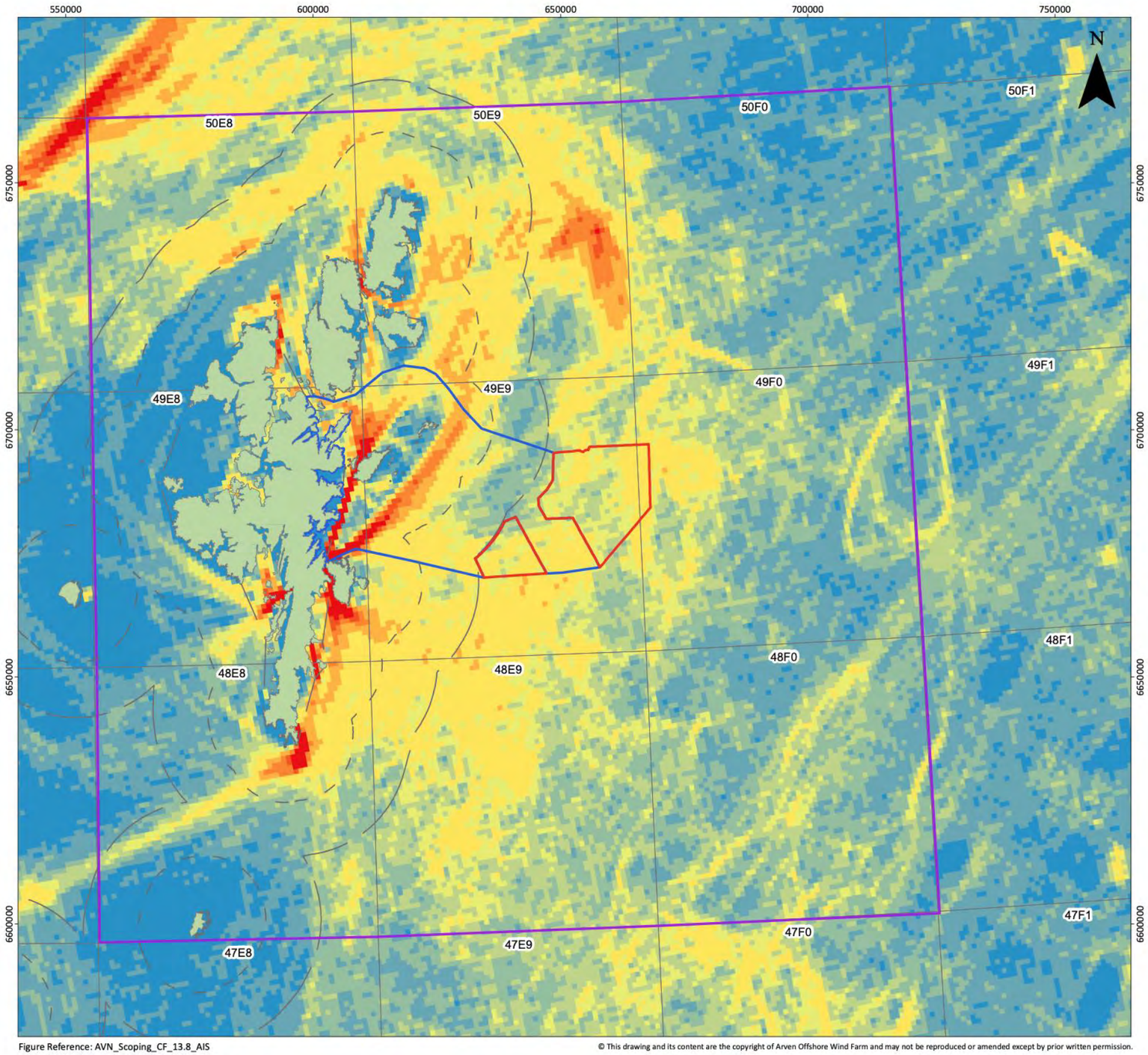
VMS data from the MMO is presented in Figure 13.10 for UK demersal otter trawl vessels 15 m and over in length. This data corroborates the ICES VMS dataset, indicating an active fishery around the 6 NM boundary, within the north Scoping Boundary and within the Array Areas. The VMS data for 2019 is presented to allow consideration for any COVID effect in 2020 data. VMS data from 2016 to 2020 will be analysed in the EIAR.

VMS data for the demersal seine fishery is presented in Figure 13.11, showing a hotspot of activity in the Arven South Array Area, close to 12 NM boundary.

VMS data for the dredge fishery is presented in Figure 13.12 and Figure 13.13 from the ICES and MMO datasets respectively. The MMO data is presented for the annual period of 2017, because this represents the highest level of activity in the 2016 to 2020 timeseries. All dredge activity is within the 6 NM boundary, with no records within the Array Areas.

VMS data is presented for the pelagic trawl fleet (Figure 13.14), with data presented for the annual period of 2019, because this represents the highest level of activity in the 2016 to 2020 timeseries. High value pelagic trawl activity is noted to be spotted throughout the Offshore Proposed Development, primarily within ICES rectangle 49E9 and the regional area south of 49E9.

Mapped spatial data for Scottish vessels under 12 m in length is provided in Figure 13.15, which shows activity in ICES rectangle 49E8, inside from the 6 NM boundary and no activity within the Array Areas.



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Scoping Report

Fishing Vessel Route Density Data

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Fishing Vessel Route Density (2022)
(Routes per Square km per year)

- 0 - 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 16,363

Notes

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Coordinate System:
WGS 1984 UTM Zone 30N

0 25 50 km
0 7.5 15 nm

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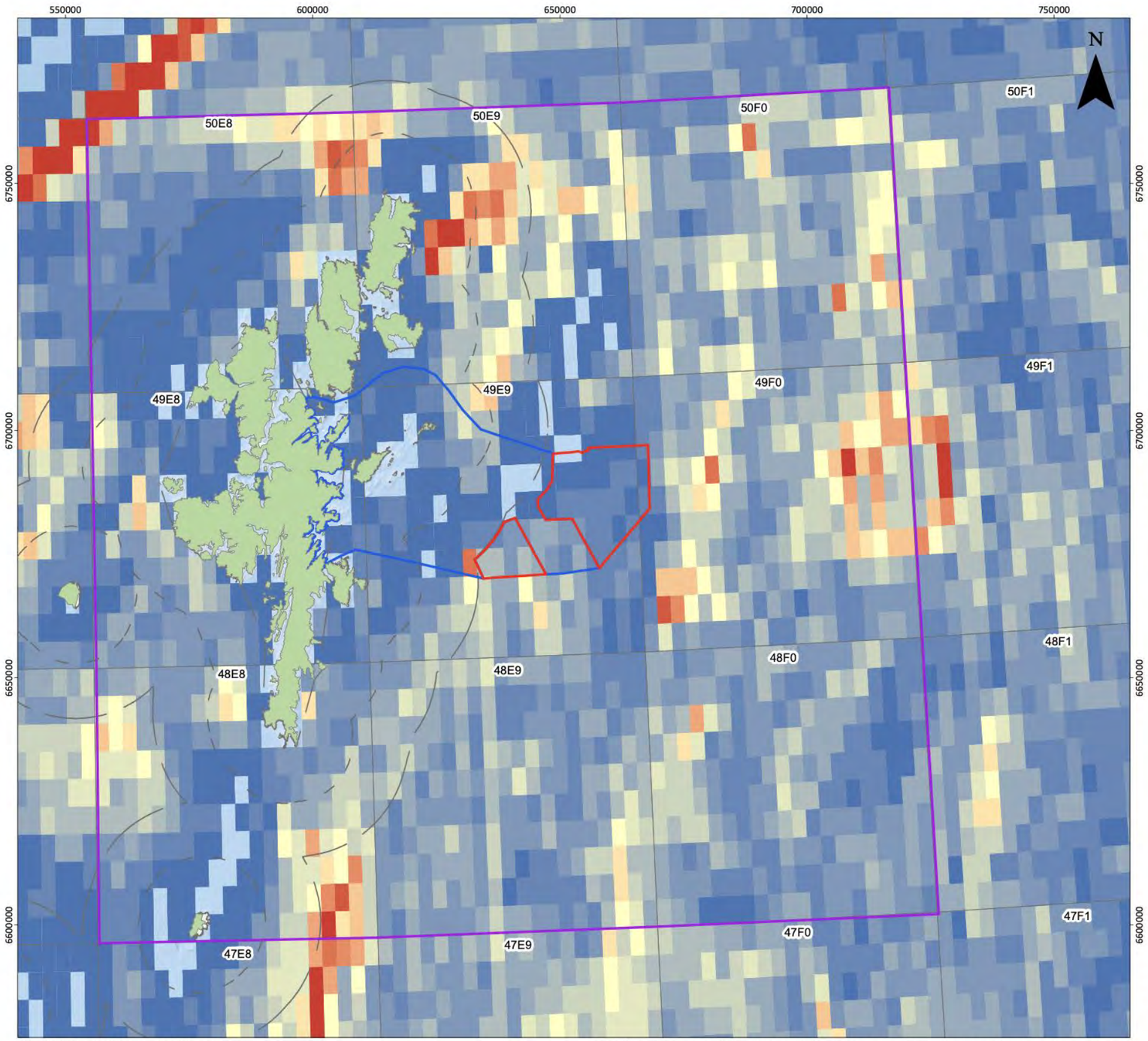
Figure 13.8

Figure 13.8: Fishing vessel route density data (Source: EMSA, 2022)



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Arven Offshore Wind Farm
Scoping Report

Commercial Fisheries
Vessel Monitoring System Data
UK and EU Demersal Otter Trawl

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Demersal Otter Trawl (EU and UK vessels ≥12m)
Average Annual Surface Swept Area Ratio (2016-2020)

0.0 - 0.6	5.2 - 5.8
0.7 - 1.3	5.9 - 6.4
1.4 - 1.9	6.5 - 7.1
2.0 - 2.6	7.2 - 7.7
2.7 - 3.2	7.8 - 8.4
3.3 - 3.9	8.5 - 9.0
4.0 - 4.5	9.1 - 23.2
4.6 - 5.1	

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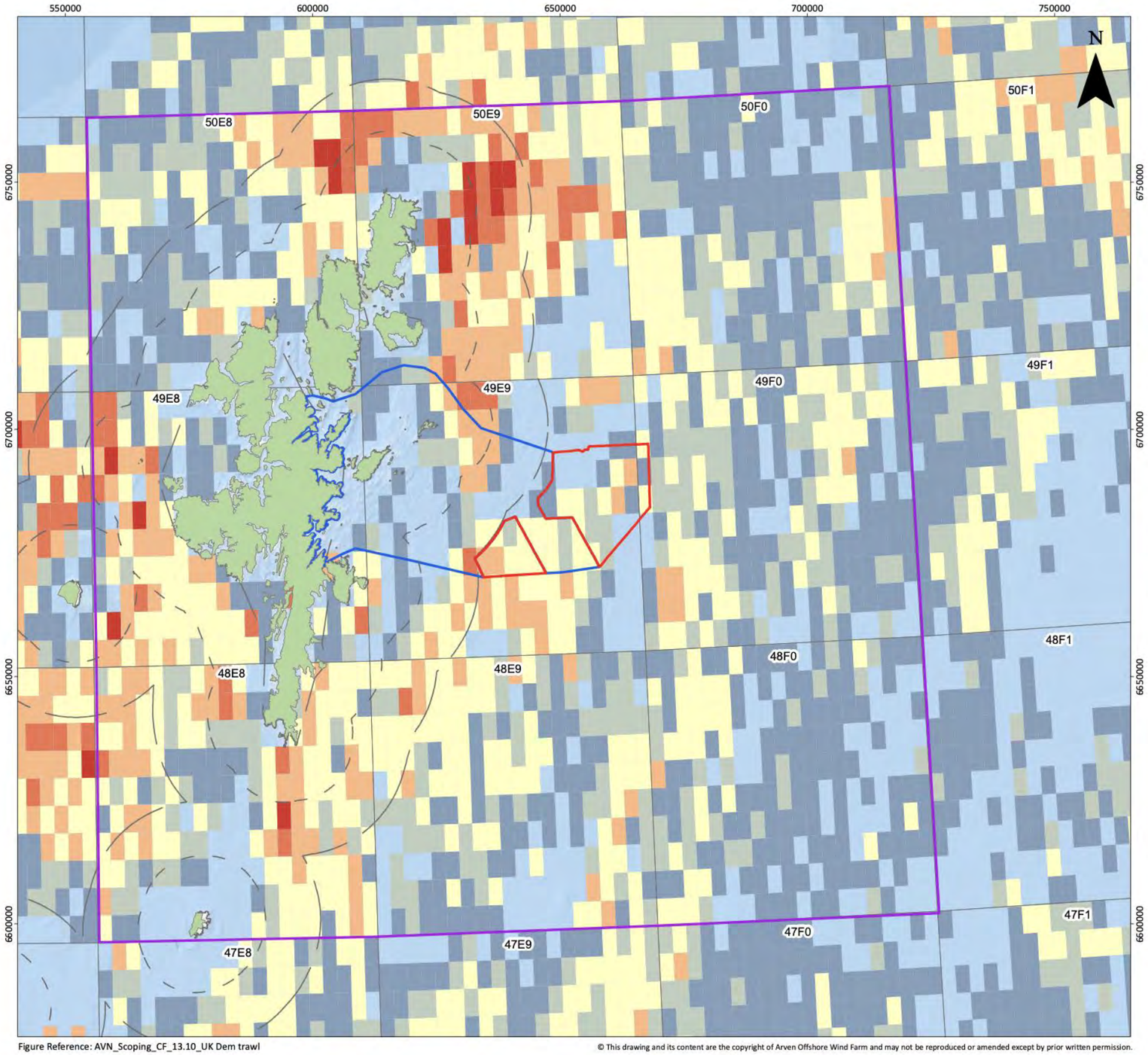
Figure 13.9

Figure Reference: AVN_Scoping_CF_13.9_ICES DemTrawl

Figure 13.9: EU (including UK) vessels ≥ 12 m length actively fishing using demersal otter trawl (Data source: ICES, 2021, based on a five-year annual average data set from 2016-2020)



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Commercial Fisheries
Vessel Monitoring System Data
UK Demersal Otter Trawl

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Demersal Otter Trawl 2019 (UK vessels ≥15m)
First Sales Value
Total value, £

- £0.02 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £25,000.00
- £25,000.01 - £50,000.00
- £50,000.01 - £75,000.00
- £75,000.01 - £111,000.00

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Figure 13.10

Figure 13.10: UK vessels ≥ 15 m length actively fishing using demersal otter trawl (Data source: MMO, 2023b, annual data set for 2019)

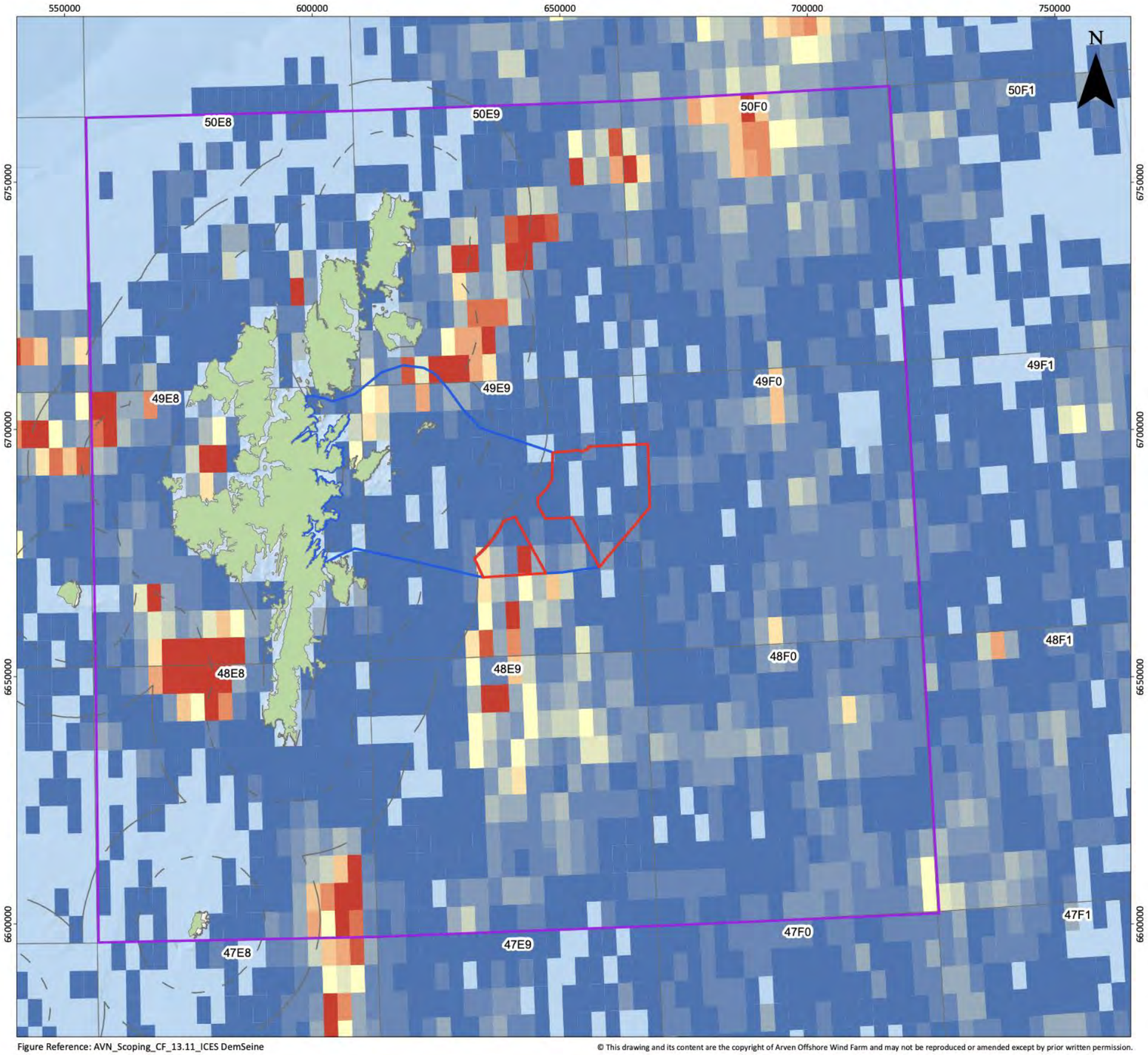

Figure Reference: AVN_Scoping_CF_13.11_ICES DemSeine

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Scoping Report

Commercial Fisheries
Vessel Monitoring System Data
UK and EU Demersal Seine

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Demersal Seine (EU and UK vessels ≥12m)
Demersal seine SAR_mean

0.0 - 0.6	5.2 - 5.8
0.7 - 1.3	5.9 - 6.4
1.4 - 1.9	6.5 - 7.1
2.0 - 2.6	7.2 - 7.7
2.7 - 3.2	7.8 - 8.4
3.3 - 3.9	8.5 - 9.0
4.0 - 4.5	9.1 - 46.8
4.6 - 5.1	

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0 7.5 15 nm

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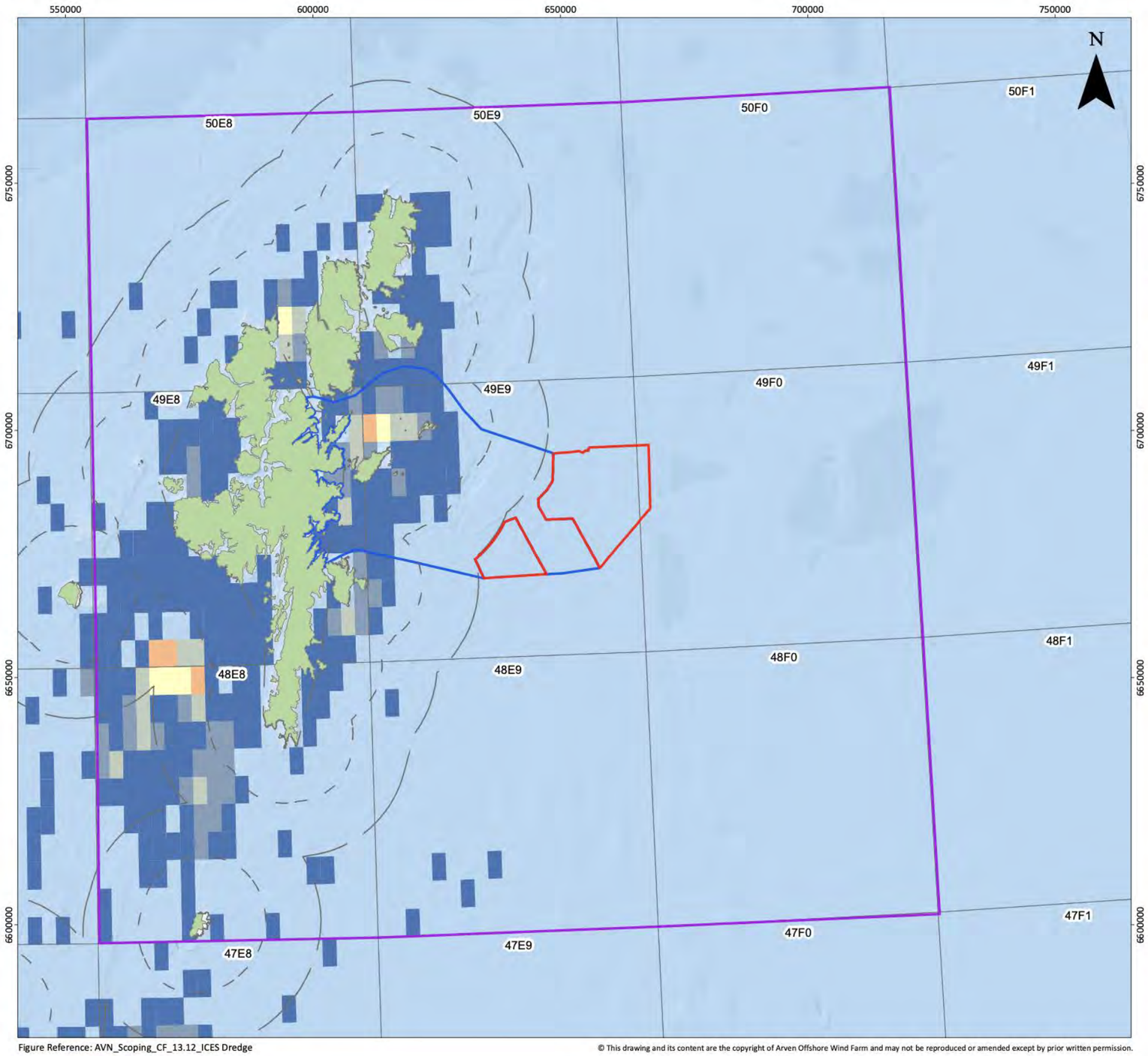
Figure 13.11

Figure 13.11: EU (including UK) vessels ≥ 12 m length actively fishing using demersal seine (Data source: ICES, 2021, based on a five-year annual average data set from 2016-2020)



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Commercial Fisheries
Vessel Monitoring System Data
UK and EU Dredge

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Dredge (EU and UK vessels ≥12m)
Average Annual Surface Swept Area Ratio (2016-2020)

- 0.0 - 0.1
- 0.1 - 0.2
- 0.3 - 0.4
- 0.5 - 0.6
- 0.7 - 0.8
- 0.9 - 2.0
- 2.1 - 3.8

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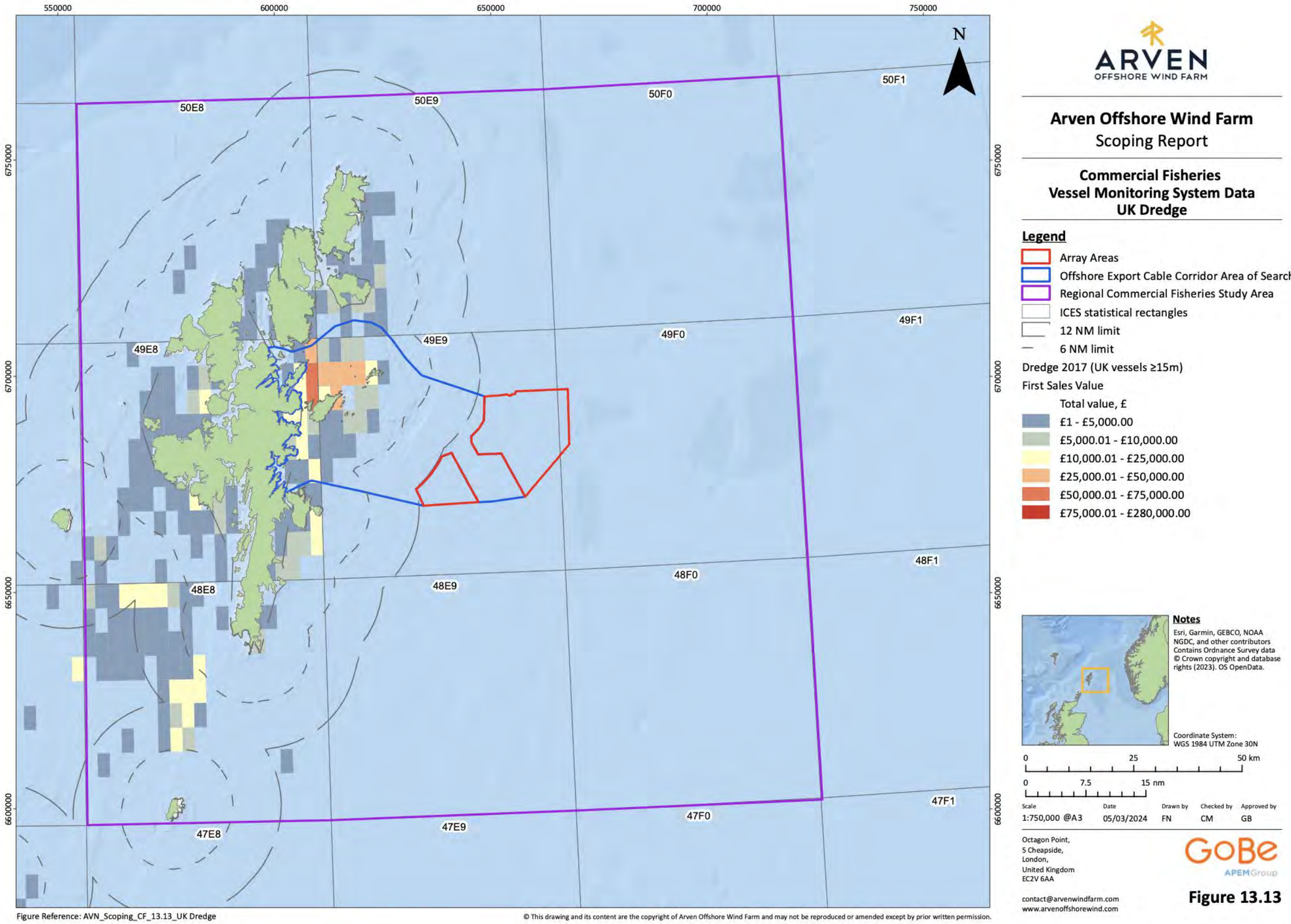
Figure 13.12

Figure Reference: AVN_Scoping_CF_13.12_ICES Dredge

Figure 13.12: EU (including UK) vessels ≥ 12 m length actively fishing using dredge (Data source: ICES, 2021, based on a five-year annual average data set from 2016-2020)



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Scoping Report

Commercial Fisheries
Vessel Monitoring System Data
UK Dredge

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Dredge 2017 (UK vessels ≥15m)
First Sales Value
Total value, £

- £1 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £25,000.00
- £25,000.01 - £50,000.00
- £50,000.01 - £75,000.00
- £75,000.01 - £280,000.00

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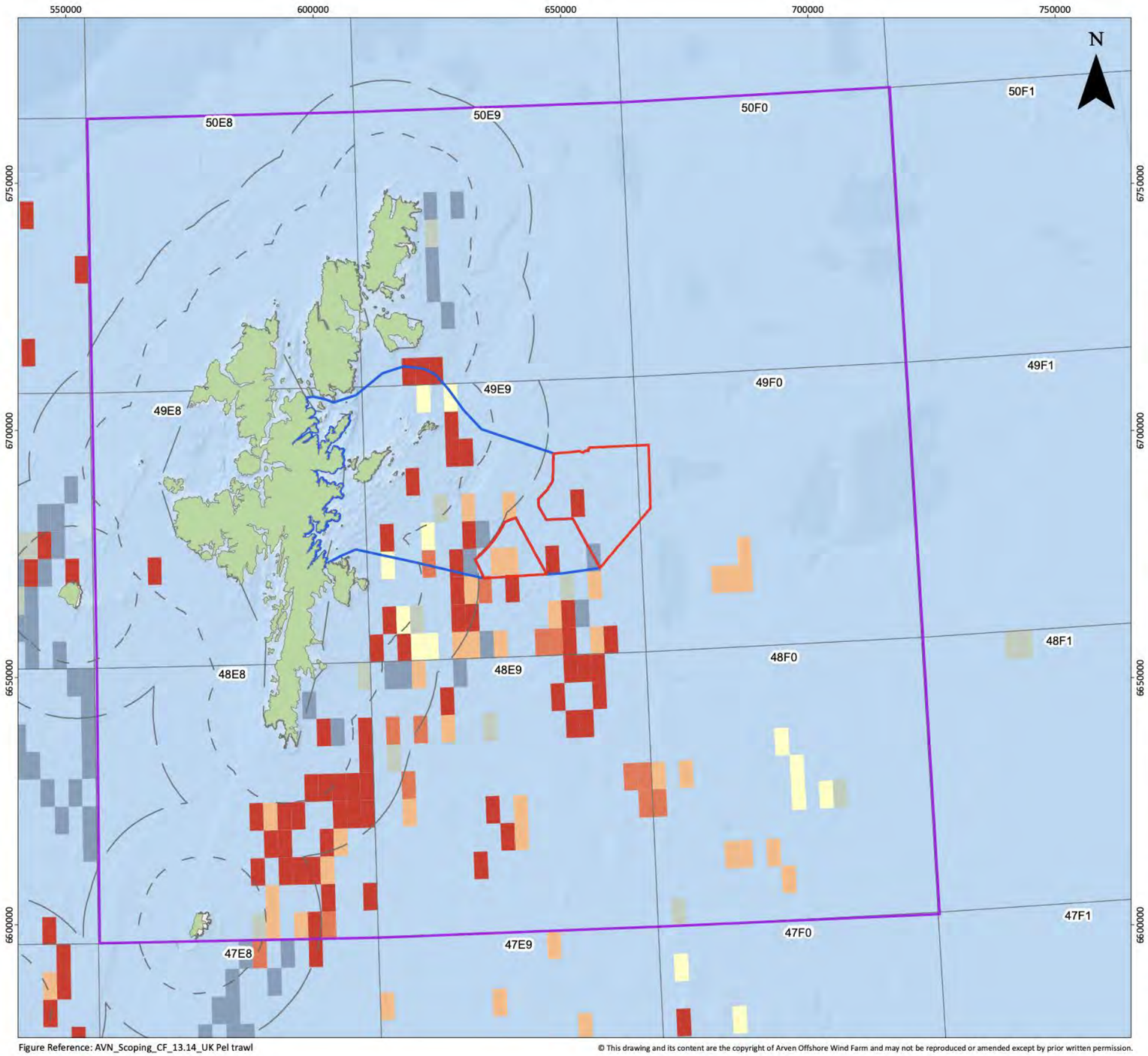
Figure 13.13

Figure 13.13: UK vessels ≥ 15 m length actively fishing using dredge (Data source: MMO, 2023b, annual data set for 2017)



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Arven Offshore Wind Farm
Scoping Report

Commercial Fisheries
Vessel Monitoring System Data
UK Pelagic Otter Trawl

Legend

- Array Area
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Pelagic Trawl 2019 (UK vessels ≥15m)
otmval

- Total value, £
- £0.02 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £25,000.00
- £25,000.01 - £50,000.00
- £50,000.01 - £75,000.00
- £75,000.01 - £267,000.00

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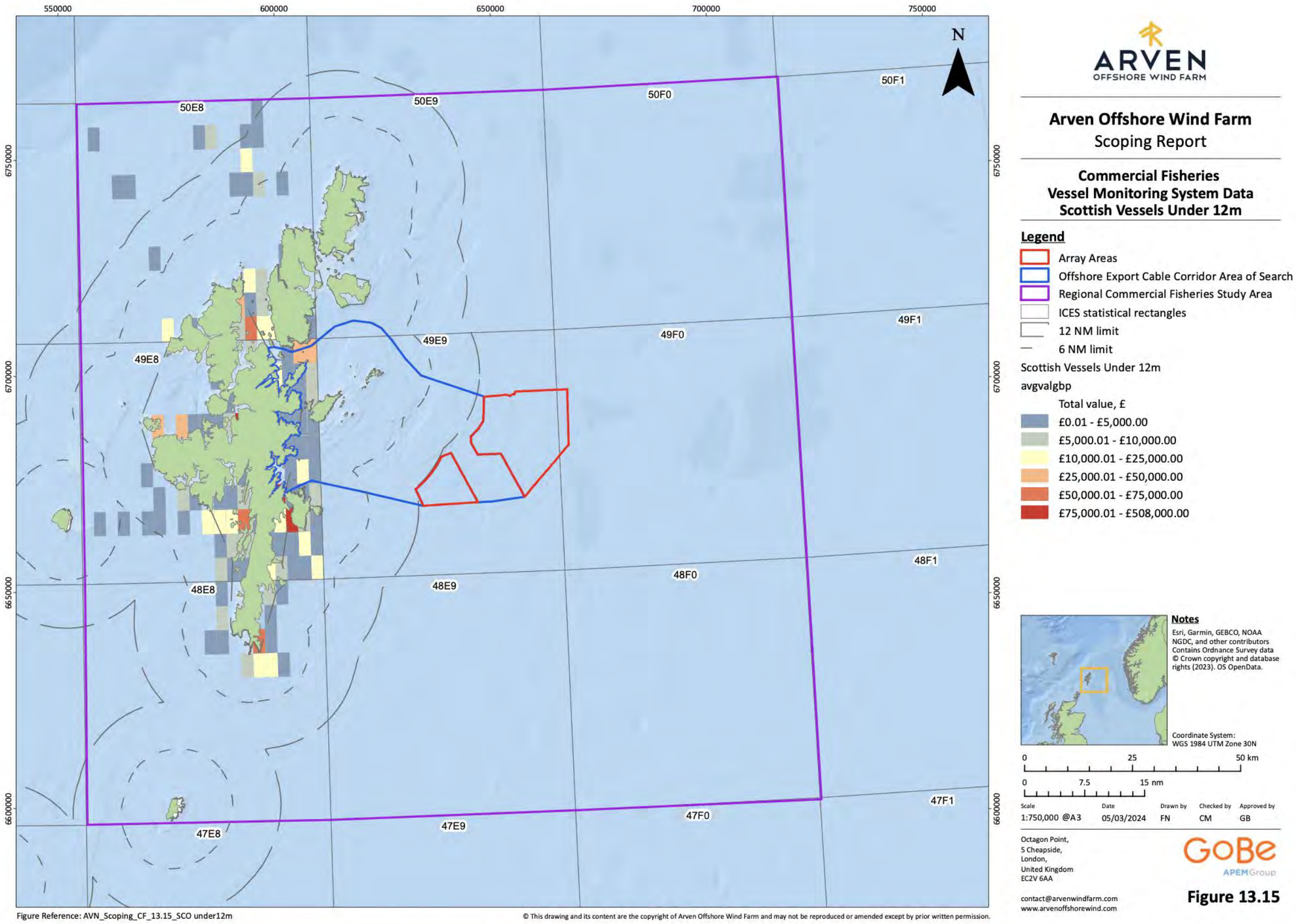
Figure 13.14

Figure Reference: AVN_Scoping_CF_13.14_UK Pel trawl

Figure 13.14: UK vessels ≥ 15 m length actively fishing using pelagic trawl (Data source: MMO, 2023b, annual data set for 2019)



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Commercial Fisheries
Vessel Monitoring System Data
Scottish Vessels Under 12m

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Regional Commercial Fisheries Study Area
- ICES statistical rectangles
- 12 NM limit
- 6 NM limit

Scottish Vessels Under 12m
avgvalgbp
Total value, £

- £0.01 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £25,000.00
- £25,000.01 - £50,000.00
- £50,000.01 - £75,000.00
- £75,000.01 - £508,000.00

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Figure 13.15

Figure 13.15: UK inshore vessels under 12 m in length actively fishing (Data source: Marine Scotland NMPi)

13.4.2 Legislation, Policy and Guidance

Table 13.2 sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the EIAR assessment where appropriate. The overarching policy and legislation relevant to the Offshore Proposed Development is described in Chapter 2: Legislation and Policy Context.

Table 13.2: Summary of Relevant Legislation, Policy and Guidance for Commercial Fisheries

Relevant legislation, policy or guidance		Relevance to the assessment
Policy	NMP (Scottish Government, 2015)	Contains sector-specific policies relevant to offshore wind and commercial fisheries.
	Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020)	Identifies plan option areas for offshore wind farm development and identifies key consenting issues associated with development.
	SIRMP (in progress)	Will focus on regional marine planning and conservation issues and will be developed in line with the NMP and SMP.
Guidance	Good Practice Guidance for assessing fisheries displacement by other licensed marine activities (Xodus, 2022)	In addition to the general approach and guidance outlined in Chapter 4: EIA Methodology, the assessment of potential impacts on commercial fisheries receptors will also comply with the listed guidance documents where they are specific to this topic.
	Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (UK Fisheries Economic Network and Seafish, 2012)	
	Fisheries Liaison with Offshore Wind and Wet Renewables group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers (FLOWW, 2014 and noted to be currently in the process of being updated; BERR, 2008)	
	FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015)	

Relevant legislation, policy or guidance	Relevance to the assessment
Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010a)	
Developing guidance on fisheries Cumulative Impact Assessment for wind farm developers (Blyth-Skyrme, 2010b)	
Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Contract report: ME5403 (Cefas, 2012)	
Fisheries Liaison Guidelines - Issue 6 (UK Oil and Gas, 2015)	
Fishing and Submarine Cables - Working Together (International Cable Protection Committee, 2009)	

13.4.3 Consultation

Consultation undertaken to date for the Offshore Proposed Development relevant to commercial fisheries is provided in Table 13.3. A stakeholder group of key fisheries representatives has been formed called the "*NE1 Fishing Forum*" to act as a working group, which includes: SSMO, Scottish Pelagic Fishermen's Association (SPFA), SFF and Scottish White Fish Producers Association (SWFPA). At the time of writing, four forum meetings have been held, inclusive of the Developer and ESB Asset Development (representing the proposed Stoura OWF).

Table 13.3: Consultation Relevant to Commercial Fisheries

Consultee	Date/Document	Discussion Points
NE1 Fishing Forum (including SSMO, SPFA, SFF, SWFPA)	December 2022	Opening meeting; role of forum and its members discussed.
	May 2023	Project updates provided for the Project and Stoura.
	November 2023	Project updates provided for the Project and Stoura.

Consultee	Date/Document	Discussion Points
		Approach to commercial fisheries EIA scoping presented. Sharing of commercial fisheries baseline data discussed.
	March 2024	Project updates provided for the Project and Stoura. Terms of Reference for the Forum discussed. Initial discussion regarding collaborative environmental monitoring.
MD-LOT, MD- SEDD, NatureScot, SIC, UHI Shetland	Scoping Workshops November 2023	Project introduction provided by the Developer. Overview of commercial fisheries engagement to date provided; key engagement has been via the NE1 Fishing Forum.
SIC Fisheries and Aquaculture Working Group	September 2023	Project updates provided for the Project and Stoura.

13.4.4 Commercial Fisheries Receptors

The key commercial fisheries receptors within the commercial fisheries study areas are identified as follows:

- UK pelagic trawlers targeting mackerel and herring (in distinct seasonal fisheries);
- UK demersal otter trawlers targeting cod, haddock, monkfish and mixed demersal fish species;
- UK demersal seine targeting haddock, whiting and mixed demersal fish species;
- UK dredgers targeting king scallop;
- UK potters targeting lobster and brown crab; and
- Non-UK (Norwegian, French, Danish and Irish) pelagic trawlers and pelagic seine targeting mackerel and herring; and
- Non-UK (Norwegian, French and Danish) demersal trawlers targeting mixed demersal fish species.

13.5 Embedded Mitigation

As part of the design process for the Offshore Proposed Development, a number of designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors.

These are presented below and in Appendix A – Commitments Register and will likely evolve over the development process as the EIAR progresses and in response to stakeholder consultation.

- C-1: Development of and adherence to a CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
- C-3: Development of and adherence to a Fisheries Management and Mitigation Strategy (FMMS). The FMMS will set out the means of ongoing fisheries liaison through construction and operation and maintenance phases of the Project and detail any mitigation measures to be put in place to limit effects on commercial fisheries activity.
- C-7: Appointment of a Company Fisheries Liaison Officer (CFLO). The CFLO will support ongoing liaison and ensure clear communication between the Project and commercial fisheries.
- C-10: Development of and adherence to a NSP. The NSP will describe measures put in place by the Project related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Project activity to other sea users (e.g. via Notice to Mariners).
- C-12: Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction Project phases.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.
- C-15: Development of and adherence to a CoP. The CoP will confirm the timing and duration of the main Project construction activities.
- C-16: Development of and adherence to a LMP. The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.
- C-17: Development of and adherence to an OMP. The OMP will describe operation and maintenance activities and provide an indicative schedule for the undertaking of these.
- C-21: Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the Project and fishing activities (e.g. FLOWW, 2014; 2015).
- C-22: Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.
- C-23: Participation in any fisheries working group to assist with liaison between the Project and the fishing community.
- C-24: Application for and use of Safety Zones of up to 500m during construction, maintenance and decommissioning phases. Where appropriate, guard vessels will also be used to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.
- C-28: Any objects dropped on the seabed during works associated with the Offshore Proposed Development will be reported and objects will be recovered where they pose a hazard to other marine users and where recovery is possible.
- C-29: Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP.
- C-32: Suitable implementation and monitoring of cable protection (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible), as detailed within the CaP.
- C-34: Appropriate marking of the Project on Admiralty and aeronautical charts. This will involve provision of the positions and heights of structures to the UKHO, CAA, MoD and DGC.

As a result of the commitment to implement these measures, and to align the Offshore Proposed Development with various standard sectoral practices and procedures, the embedded mitigations are considered inherently part of the design of the Offshore Proposed Development.

The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon commercial fisheries and will be consulted upon with statutory consultees throughout the EIA process.

13.6 Scoping of Impacts

The following potential impacts on commercial fisheries are considered in this scoping exercise:

- Reduction in access to, or exclusion from established fishing grounds within the Array Areas during all project phases.
- Reduction in access to, or exclusion from established fishing grounds within the OfECC during all project phases.
- Displacement leading to gear conflict and increased fishing pressure on adjacent grounds during all project phases.
- Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity during all project phases.
- Increased vessel traffic associated with the Offshore Proposed Development within fishing grounds leading to interference with fishing activity during all project phases.
- Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Offshore Proposed Development during all project phases.
- Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging during all project phases.

It is noted that Chapter 15: Shipping and Navigation considers impacts on the navigational safety aspects of fishing activity, and Chapter 9: Fish and Shellfish Ecology considers impacts on the ecology of fish and shellfish, including species of commercial interest.

The sections below set out an initial assessment of the likelihood of effects on commercial fisheries due to Offshore Proposed Development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the Offshore Proposed Development at the scoping stage; embedded mitigation; the level of understanding of the baseline at the scoping stage; the existing evidence base for commercial fisheries effects due to Offshore Proposed Development activities; relevant policy; and the professional judgement of qualified commercial fisheries specialists.

13.6.1 Potential Impacts Scoped In

Table 13.4 sets out those impacts on commercial fisheries that are proposed to be scoped into the EIAR, accompanied by a justification for this.

Table 13.4: Impacts scoped into the commercial fisheries chapter in the Offshore Proposed Development EIAR

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction (and Decommissioning)			
Reduction in access to, or exclusion from established fishing grounds	Installation and decommissioning activities have potential to create loss of fishing opportunities. This effect is expected to be localised and short term; furthermore, the operational range of relevant fleets will not typically be limited to the Offshore Proposed Development.	Desktop study, analysis of statistics and geographic information systems (GIS) supported by consultation with stakeholders.	C-1 (CaP), C-3 (FMMS), C-7 (CFLO), C-10 (NSP), C-12 (PEMP), C-14 (DP), C-15 (CoP), C-16 (LMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones), C-28 (dropped objects), C-29 (cable burial), C-32 (cable protection monitoring), C-34 (marking on charts)
Temporary displacement of fishing activity leading to gear conflict and increased fishing pressure on adjacent grounds	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This effect is expected to be short-term and the operational range of relevant fleets will not typically be limited to the Offshore Proposed Development.	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.	C-1 (CaP), C-3 (FMMS), C-7 (CFLO), C-12 (PEMP), C-14 (DP), C-15 (CoP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones), C-29 (cable

Impact	Description	Proposed Assessment Approach	Embedded mitigation
			burial), C-32 (cable protection monitoring), C-34 (marking on charts)
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	Installation and decommissioning activities may lead to disturbance of commercially important fish and shellfish resources, which in turn may displace or disrupt a range of fishing activity. Assessment will be informed by the outcomes of the fish and shellfish ecology impact assessment, and it will be assumed that commercial fisheries will be affected as a result of any loss of resources.	Desktop study supported by Fish and Shellfish Ecology Chapter and consultation with stakeholders.	C-3 (FMMS), C-7 (CFLO), C-12 (PEMP), C-14 (DP), C-15 (CoP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-29 (cable burial), C-32 (cable protection monitoring)
Increased vessel traffic associated with the Offshore Proposed Development within fishing grounds leading to interference with fishing activity	Movement of vessels associated with the Offshore Proposed Development adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Assessment will be informed by the outcomes of the shipping and navigation impact assessment and Navigational Risk Assessment (NRA)	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.	C-3 (FMMS), C-7 (CFLO), C-10 (NSP), C-14 (DP), C-15 (CoP), C-16 (LMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones), C-34 (marking on charts)
Physical presence of infrastructure and potential	The presence of partially constructed infrastructure (e.g. cable/scour protection, subsea cable hubs) and other seabed obstacles, may pose a snagging risk to fishing	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.	C-1 (CaP), C-3 (FMMS), C-7 (CFLO), C-14 (DP), C-16 (LMP), C-21 (FLOWW guidance), C-22

Impact	Description	Proposed Approach	Assessment	Embedded mitigation
exposure of that infrastructure leading to gear snagging	vessels, which could result in loss or damage to fishing gear.			(advance warning), C-23 (working group), C-24 (Safety Zones), C-28 (dropped objects), C-29 (cable burial), C-32 (cable protection monitoring), C-34 (marking on charts)
Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Offshore Proposed Development	Installation and decommissioning activities have the potential to create loss of fishing opportunities. Seeking alternative fishing grounds may lead to additional steaming time.	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.		C-3 (FMMS), C-7 (CFLO), C-10 (NSP), C-14 (DP), C-15 (CoP), C-16 (LMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones)
Operation and Maintenance				
Reduction in access to, or exclusion from established fishing grounds	The presence of offshore infrastructure within the Offshore Proposed Development may result in a loss or restricted access to fishing grounds during the operation and maintenance phase. As floating offshore wind is a relatively new technology, there is limited information available on the scale of this impact. Access to fishing grounds within the Offshore Proposed Development will be dependent on turbine	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.		C-1 (CaP), C-3 (FMMS), C-7 (CFLO), C-10 (NSP), C-12 (PEMP), C-16 (LMP), C-17 (OMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones), C-28 (dropped objects), C-29

Impact	Description	Proposed Approach	Assessment	Embedded mitigation
	spacing, turbine layout, floating substructure type and station keeping system design. In particular, the mooring associated with the station keeping system and any dynamic inter-array cable design may affect the ability of commercial fishing fleets in deploying fishing gear.			(cable burial), C-32 (cable protection monitoring), C-34 (marking on charts)
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This effect is expected to be medium-long term and the operational range of relevant fleets will not typically be limited to the Offshore Proposed Development.	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.		C-1 (CaP), C-3 (FMMS), C-7 (CFLO), C-12 (PEMP), C-17 (OMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones), C-29 (cable burial), C-32 (cable protection monitoring), C-34 (marking on charts)
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	Operation and maintenance of the Offshore Proposed Development may lead to disturbance of commercially important fish and shellfish resources, including EMF from inter-array cables, and changes to habitat, and therefore displace or disrupt a range of fishing activity. Assessment will be informed by the	Desktop study supported by Fish and Shellfish Ecology Chapter and consultation with stakeholders.		C-3 (FMMS), C-7 (CFLO), C-12 (PEMP), C-17 (OMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-29 (cable

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	outcomes of the fish and shellfish ecology impact assessment, and it will be assumed that commercial fisheries will be affected as a result of any loss of resources.		burial), C-32 (cable protection monitoring)
Increased vessel traffic associated with the Offshore Proposed Development within fishing grounds leading to interference with fishing activity	Movement of vessels associated with operation and maintenance of the Offshore Proposed Development adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Assessment will be informed by the outcomes of the shipping and navigation impact assessment and NRA	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.	C-3 (FMMS), C-7 (CFLO), C-10 (NSP), C-16 (LMP), C-17 (OMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones), C-34 (marking on charts)
Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	The presence of infrastructure associated with operation and maintenance (e.g. cable/scour protection, subsea cable hubs) and other seabed obstacles, may pose a snagging risk to fishing vessels, which could result in loss or damage to fishing gear. The extent of impact may vary depending upon the project design. Standard industry practice and protocol (e.g., seabed infrastructure will be buried and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern. Safety aspects	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.	C-1 (CaP), C-3 (FMMS), C-7 (CFLO), C-16 (LMP), C-17 (OMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones), C-28 (dropped objects), C-29 (cable burial), C-32 (cable protection monitoring), C-34 (marking on charts)

Impact	Description	Proposed Approach	Assessment	Embedded mitigation
	associated with this impact, including damage to property and vessel stability, will be considered within the shipping and navigation impact assessment.			
Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Offshore Proposed Development	The presence of offshore infrastructure within the Offshore Proposed Development may result in a loss or restricted access to fishing grounds during the operation and maintenance phase. Seeking alternative fishing grounds may lead to additional steaming time.	Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.		C-3 (FMMS), C-7 (CFLO), C-10 (NSP), C-16 (LMP), C-17 (OMP), C-21 (FLOWW guidance), C-22 (advance warning), C-23 (working group), C-24 (Safety Zones)

13.6.2 Potential Impacts Scoped Out

No impacts are scoped out of the commercial fisheries assessment.

13.7 Potential Cumulative Impacts

Chapter 4: EIA Methodology details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment.

Offshore wind projects and other activities, such as subsea cables and pipelines, relevant to the assessment of cumulative impacts on commercial fisheries will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of the EIAR will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e., they occur only within Offshore Proposed Development boundaries) or where management and mitigation measures in place for the Offshore Proposed Development and other projects will reduce the risk of impacts occurring. Key potential cumulative impacts are expected to result from a loss or restricted access to established fishing grounds and displacement of fishing activity.

13.8 Potential Transboundary Effects

Transboundary impacts are scoped into the assessment and will be considered based on any potential displacement of fishing activity into the Norwegian EEZ.

13.9 Proposed Approach to EIA

13.9.1 Consultation

Consultation with the commercial fishing industry will be undertaken in order to ground-truth available baseline data and gain further understanding of commercial fisheries activity by smaller vessels across the inshore portion of the study area. Consultation will be undertaken with a number of relevant stakeholders, including the following:

- Scottish Pelagic Fishermen's Association;
- Shetland Shellfish Management Organisation;
- Shetland Fishermen's Association;
- Scottish Fishermen's Federation;
- Scottish White Fish Producers Association;
- Shetland Regional Inshore Fisheries Group;
- Other local fishermen's associations and existing commercial fisheries working groups;
- Individual fishermen as identified by the FLO/other means;
- Any Norwegian and EU Member State representative organisations as identified during baseline data analysis.

Analysis of data and the results of consultation will provide an extended baseline characterisation of the study areas, which will underpin and inform the impact assessment.

No site-specific commercial fisheries surveys are proposed to inform the commercial fisheries Offshore Proposed Development EIAR chapter.

13.9.2 Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report. Definitions specific to commercial fisheries in relation to assessing the sensitivity of the receptor and magnitude of an impact will be provided to frame the assessment.

Where relevant, the impact assessment will be informed by the outcomes of the fish and shellfish ecology and shipping and navigation assessments.

Impacts will be assessed for each relevant fleet/fishery active across the regional study area.

13.10 Scoping Questions

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:

- Do you agree with the study areas defined for commercial fisheries?
- Do you agree with the data sources to be used to characterise the commercial fisheries baseline within the EIAR?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of the Offshore Proposed Development on commercial fisheries receptors?
- Do you agree with the proposed study areas identified for the commercial fisheries receptors?
- Do you agree with the scoping in and out of impact pathways in relation to commercial fisheries?
- Do you agree with the proposed assessment methodology for commercial fisheries?
- Do you agree with the approach for the transboundary assessment?
- Do you agree with the approach for CIA?
- Do you have any other matters or information sources that you wish to present?

14 Aviation and Radar

14.1 Introduction

This chapter of the Offshore Scoping Report identifies military and civil aviation receptors of relevance to the Offshore Proposed Development and considers the potential impacts from the construction, O&M and decommissioning of the Offshore Proposed Development, on Aviation and Radar.

WTGs have the potential to cause a variety of adverse effects on aviation receptors. WTGs can impact radars used by civilian and military air traffic controllers because the characteristics of moving turbine blades is similar to those of an aircraft, leading to spurious returns, or clutter on radar displays. This can affect the safe provision of air traffic services or interfere with tracking of aircraft by the military. WTGs also have the potential to present a physical obstruction for aviation activities, such as military low flying or helicopter Search and Rescue (SAR) operations.

Aviation stakeholders potentially affected include the CAA, NATS, the MOD, CAA Norway, HIAL, and offshore helicopter operators such as Bristow Group, who currently delivers the UK SAR contract on behalf of His Majesty's Coastguard (HMC).

This chapter should be read in conjunction with:

- Chapter 15: Shipping and Navigation.

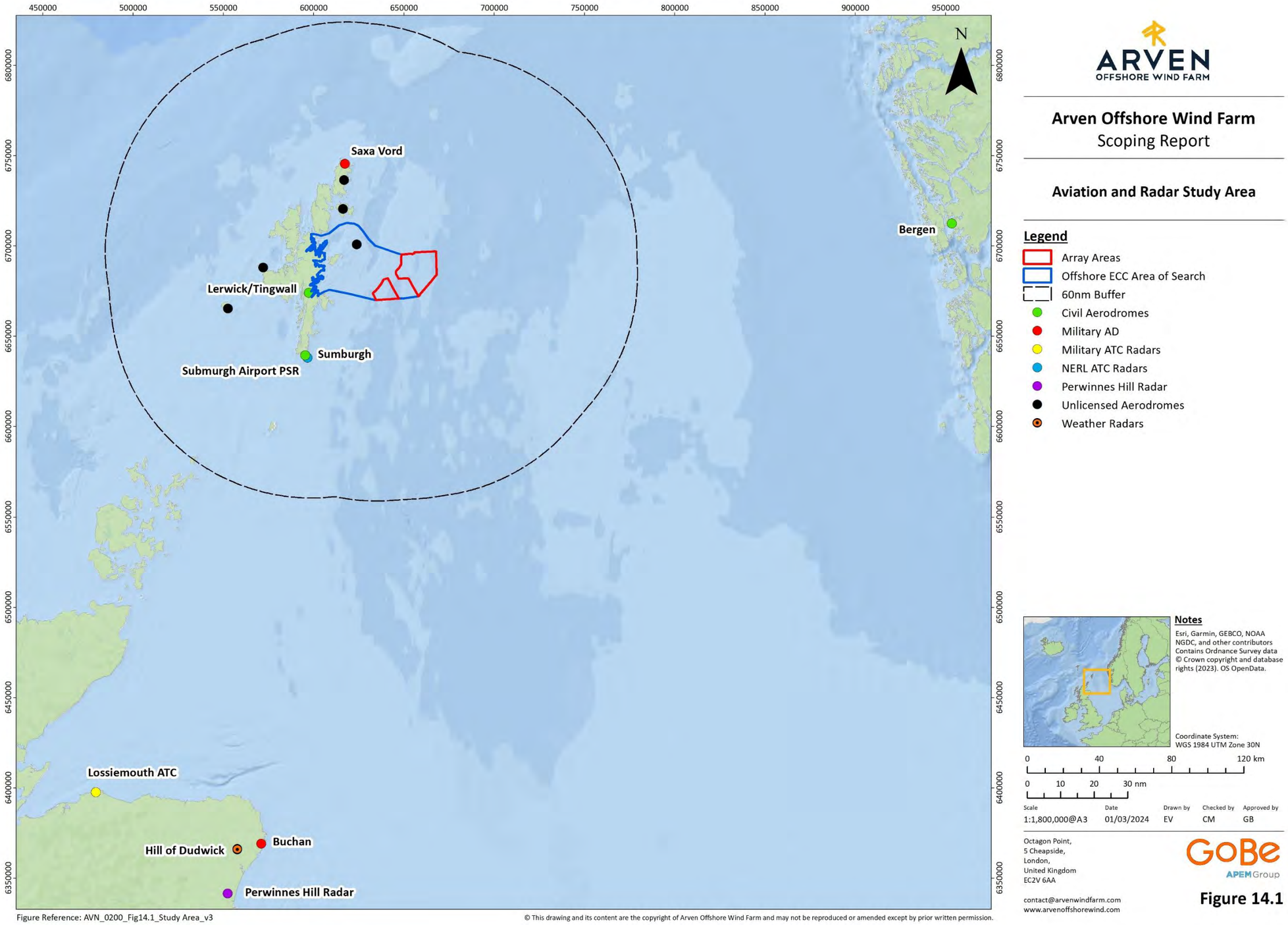
This chapter of the Offshore Scoping Report has been prepared by Cyrrus Ltd.

14.2 Study Area

14.2.1 Overview

The Aviation and Radar study area is defined by the potential for WTGs within the Offshore Proposed Development Array Areas, to have an impact on civil and military radars when considering the required radar's operational ranges. In general, Primary Surveillance Radars (PSRs) installed on civil and military airfields have an operational range between 40 nautical miles (nm) and 60 nm. All radar-equipped airfields within a 60 nm radius of the Array Areas are therefore included in this study area. Enroute radars operated by NATS (En Route) plc (NERL) and Air Defence (AD) radars are required to provide coverage at ranges in excess of 60 nm and so all such radars with potential Radar Line of Sight (RLoS) are also included within the study area.

The aviation study area is defined by the Offshore Proposed Development footprint, plus an appropriate buffer. This includes the airspace between the Array Areas and the UK and Norwegian mainland, extending from Bergen Airport to the east, to the Hill of Dudwick weather radar to the south. Airports and radars within the study area that are under consideration as part of this Offshore Scoping Report are shown within Figure 14.1.



ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

Aviation and Radar Study Area

Legend
- Array Areas
- Offshore ECC Area of Search
- 60nm Buffer
- Civil Aerodromes
- Military AD
- Military ATC Radars
- NERL ATC Radars
- Perwinnes Hill Radar
- Unlicensed Aerodromes
- Weather Radars

Notes
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
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Coordinate System:
WGS 1984 UTM Zone 30N

0 40 80 120 km
0 10 20 30 nm

Scale	Date	Drawn by	Checked by	Approved by
1:1,800,000@A3	01/03/2024	EV	CM	GB

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GoBe
APEM Group

Figure 14.1

Figure Reference: AVN_0200_Fig14.1_Study Area_v3

Figure 14.1: Aviation and Radar Study Area

The following criteria have been used to identify receptors within the study area (and are discussed further below):

- Civil Aerodromes;
- MoD Facilities;
- NERL Facilities;
- Meteorological radio facilities; and
- Other Aviation Activities.

14.2.2 Civil Aerodromes

The Civil Aviation Publication (CAP 764) Policy and Guidelines on Wind Turbines (CAA, 2016) states the distances from various aerodromes where consultation is necessary. These distances include:

- Aerodromes with a surveillance radar – 30 km;
- Non-radar equipped licensed aerodromes with a runway of more than 1,100 m – 17 km;
- Non-radar equipped licensed aerodromes with a runway less than 1,100 m – 5 km;
- Licensed aerodromes where the WTGs will lie within airspace coincidental with any published Instrument Flight Procedure (IFP);
- Unlicensed aerodromes with runways of more than 800 m – 4 km;
- Unlicensed aerodromes with runways less than 800 m – 3 km;
- Gliding sites – 10 km; and
- Other aviation activities such as parachute sites and microlight sites – 3 km.

CAP 764 states that these distances are for guideline purposes only and do not represent ranges beyond which all WTG developments will be approved or within which they will always be objected to. For example, aerodromes may utilise their radars at ranges in excess of 30 km. These ranges are intended as a prompt for discussion between aviation stakeholders and developers.

As well as examining the technical impact of WTGs on Air Traffic Control (ATC) facilities, it is necessary to consider the physical safeguarding of ATC operations using the criteria laid out in CAP 168 Licensing of Aerodromes (CAA, 2022) to determine whether the Offshore Proposed Development will breach obstacle clearance criteria.

14.2.3 Ministry of Defence Facilities

Aviation, AD and other activities of the MoD must also be considered, this includes:

- MoD airfields, both radar and non-radar equipped;
- MoD AD Radars; and
- MoD Practice and Exercise Areas (PEXAs) for both aviation and non-aviation activities.

14.2.4 NERL Facilities

The possible effects of WTGs on NERL radar systems, a network of primary and secondary radar facilities around the country, must also be considered.

14.2.5 Meteorological Radio Facilities

WTGs have the potential to adversely impact meteorological facilities, such as weather radars. The Meteorological (MET) Office must be consulted by developers for WTG proposals within a 20 km radius zone of any of their UK weather radar sites.

14.2.6 Other Aviation Activities

Other aviation activities could include:

- General low flying operations;
- Military and civilian 'off-route' fixed-wing and helicopter operations, including SAR missions and offshore helicopter operations in support of the oil and gas industry; and
- Other aviation activity.

14.3 Data Sources at Scoping

Table 14.1: Data sources used to inform Aviation and Radar scoping chapter.

Title	Summary	Source	Author and year
CAP 032 UK Aeronautical Information Publication (AIP)	Contains information on facilities, services, rules, regulations, and restrictions in UK airspace.	https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/	CAA, 2023
UK Military AIP	The main resource for information on flight procedures at all military aerodromes.	https://www.aidu.mod.uk/aip/	MOD, 2023
Self Assessment Maps	Maps provided by NATS to ascertain potential impact of WTG on their en route electronic infrastructure.	https://www.nats.aero/services-products/catalogue/n/wind-farms-self-assessment-maps/	NATS, 2023
Offshore Infrastructure Data	Monthly updated North Sea Transition Authority (NSTA) offshore shapefiles.	https://www.nstauthority.co.uk/data-and-insights/	NSTA, 2023
Offshore Certificates	Contains up to date list of offshore helideck certifications.	https://www.helidecks.org/information/certificates/	Helideck Certification Agency (HCA)

Title	Summary	Source	Author and year
Operational Programme for the Exchange of Weather Radar Information (OPERA) Database.	Contains all weather radar positions and heights for the UK.	https://www.eumetnet.eu/activities/observations-programme/current-activities/opera/	European National Meteorological Services (EUMETNET), 2023.
eAIP Norway	Contains information on facilities, services, rules, regulations, and restrictions in Norwegian airspace.	https://avinor.no/en/ais/	CAA Norway, 2023
SG36514 Arven Offshore Wind Farm – Technical and Operational Assessment (TOPA) Issue 2	Project-specific report of NATS radars potentially impacted by WTGs within the Arven Offshore Wind Farm		NATS, 2023
MoD Pre-Application Advice	Pre-application advice sought from the MoD regarding the Offshore Proposed Development		MoD, 2024

14.4 Baseline Environment

14.4.1 Civil Airspace

14.4.1.1 British Airspace

The airspace above and adjacent to the Offshore Proposed Development Array Areas is used by civil and military aircraft and lie within both the Scottish Flight information Region (FIR) and the Polaris FIR. Most of the Array Areas lies within the Scottish FIR which is regulated by the UK CAA. The eastern extent of the Array Areas lies within the Polaris FIR which is regulated by CAA Norway. The Scottish and Polaris FIR boundary is illustrated within Figure 14.2.

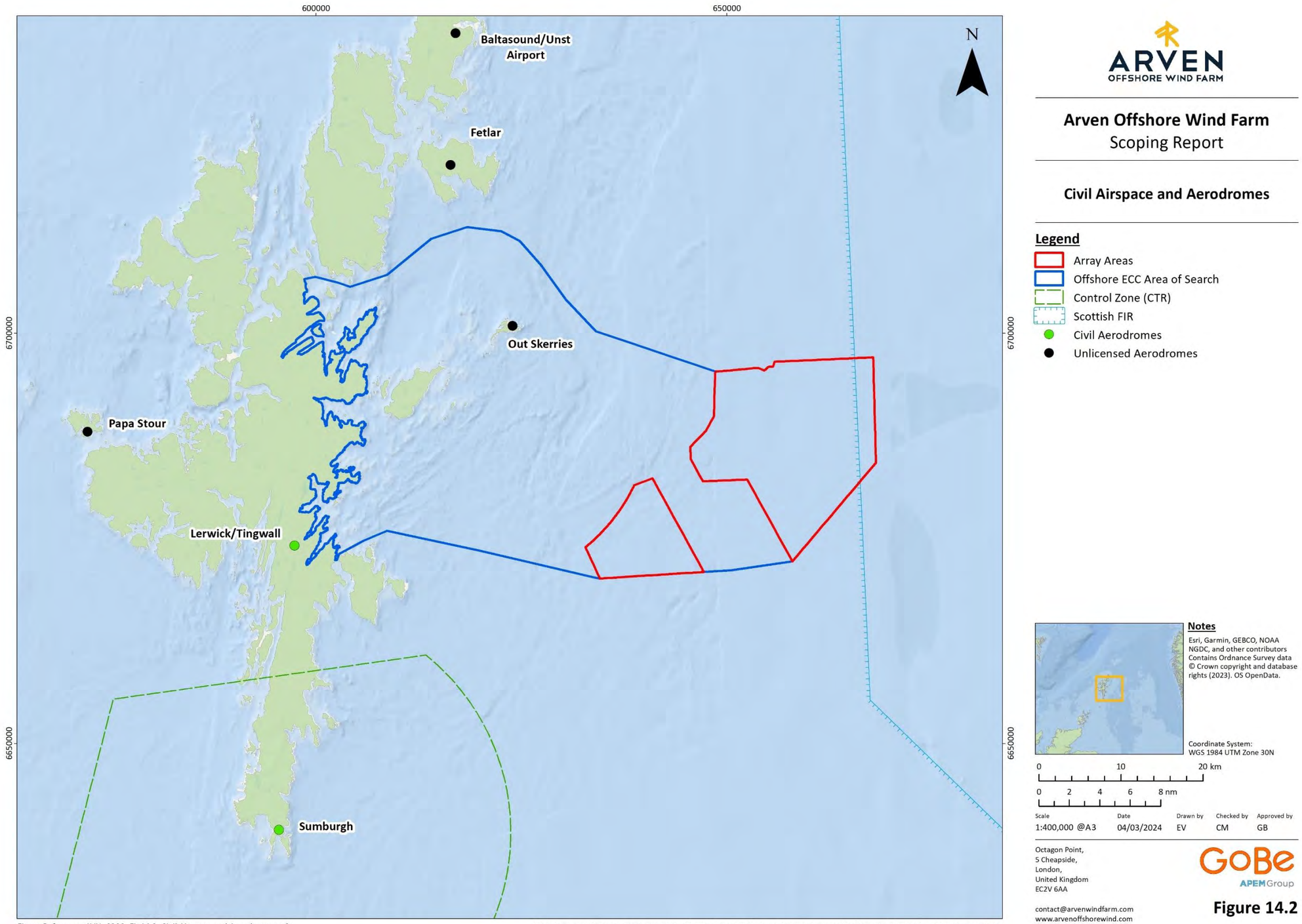


Figure 14.2: Civil Airspace and Aerodromes

Airspace is classified as either controlled or uncontrolled and is divided into a number of classes depending on what kind of Air Traffic Services (ATS) is provided and under what conditions. In the UK, there are five classes of airspace, specifically A, C, D, E, and G. The first four are controlled airspace while class G is uncontrolled. Within controlled airspace, aircraft are monitored and instructed by ATC. Aircraft within uncontrolled airspace are not subject to ATC but rather operate according to a simple set of regulations. ATC may still provide information, if requested, to ensure flight safety.

Aircraft operate under two flight rules: Visual Flight Rules (VFR) or Instrument Flight Rules (IFR). VFR flight is conducted with visual reference to the natural horizon while IFR flight requires reference solely to aircraft instrumentation.

From sea level to Flight Level (FL) 195 (approximately 19,500 ft Above Mean Sea Level (AMSL)), the airspace in the vicinity of the Array Areas is class G uncontrolled airspace. This airspace is used predominately by low level flying operations and generally by aircraft flying under VFR. Under VFR, the pilot is responsible for maintaining a safe distance from terrain, obstacles, and other aircraft.

Within the Scottish FIR, all airspace above FL 195 (approximately 19,500 ft AMSL) is class C controlled airspace.

14.4.1.2 Norwegian Airspace

The eastern section of the Array Areas lies within Polaris FIR. Within Polaris FIR, there are four classes of airspace, A, C, D and G. The first three are controlled airspace, while class G is uncontrolled. Within controlled airspace, aircraft are monitored and instructed by ATC. The Array Areas infringe on Polaris FIR class G uncontrolled airspace from sea level to FL 195 (approximately 19,500 ft AMSL) as displayed in Figure 14.2.

Laterally, the closest controlled airspace within the Scottish FIR to the Offshore Proposed Development Array Areas, is the Sumburgh Control Zone (CTR) class D controlled airspace, which is active from sea level to FL 100 (approximately 10,000 ft AMSL). Sumburgh CTR is illustrated in Figure 14.2.

14.4.2 Civil Aerodromes

The nearest licensed UK civil airport is Lerwick/Tingwall Airport, located 35.4 km to the west of the Offshore Proposed Development Array Areas. Lerwick/Tingwall Airport has no established IFPs and has a runway length of 810 m. Furthermore, the Array Areas are located beyond the 5 km consultation zone established around this aerodrome.

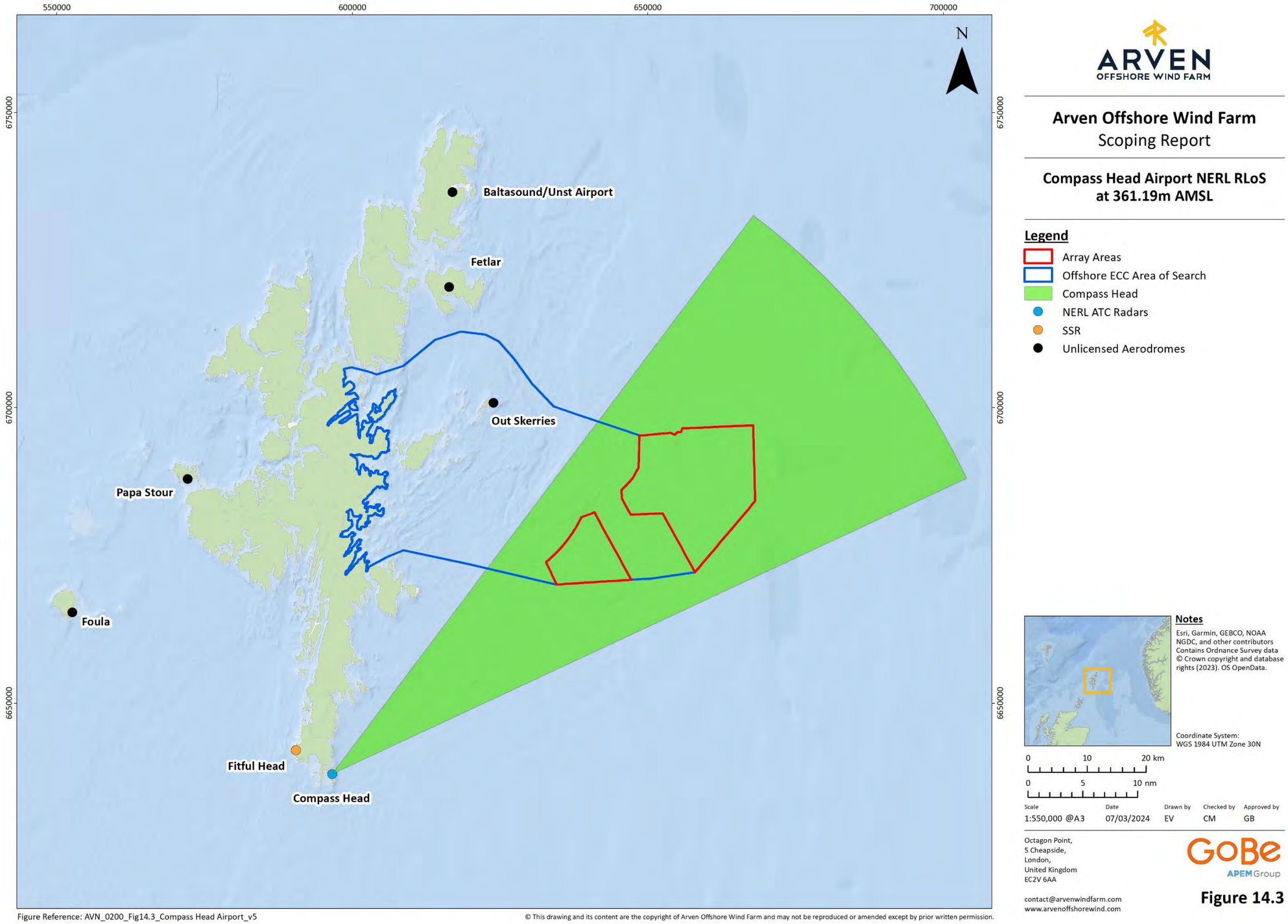
The closest UK Civil Airport with associated IFPs is Sumburgh Airport, located 49.7 km to the southwest of the Array Areas. Sumburgh Airport has associated IFPs which WTGs within the Offshore Proposed Development Array Areas will potentially impact. The impact on Sumburgh IFPs will be determined by specialist analysis and consultation with HIAL.

The closest unlicensed aerodrome to the Array Areas is the Out Skerries Airstrip, located 24.4 km to the northwest as displayed within Figure 14.3. This airstrip has a runway length of 371 m, and a consultation range

of 3 km. The Offshore Proposed Development Array Areas are located 21.4 km outside of this zone at the nearest point.

14.4.3 Civil Radars

NERL provides en route civil air traffic services within the Scottish FIR and operates a network of radar facilities providing en route information for both civil and military aircraft. The closest NERL radar to the Offshore Proposed Development Array Areas is Compass Head, located 49.7 km to the southwest of the Array Areas. Preliminary RLoS analysis indicates that WTGs with a maximum tip height of 361.19 m AMSL within the Offshore Proposed Development Array Areas will be visible to Compass Head PSR. Compass Head RLoS is displayed in Figure 14.3. The TOPA produced by NATS states that the development is likely to cause false primary plots and reduce the probability of detection of real aircraft. Furthermore, the TOPA continues to state that Aberdeen Offshore ATC deem this technical impact as 'unacceptable'.



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Compass Head Airport NERL RLoS at 361.19m AMSL

Legend
- Array Areas
- Offshore ECC Area of Search
- Compass Head
- NERL ATC Radars
- SSR
- Unlicensed Aerodromes

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Figure 14.3

Figure Reference: AVN_0200_Fig14.3_Compass Head Airport_v5

Figure 14.3: Compass Head NERL PSR RLoS at 361.19 m AMSL

The effects WTGs have on Secondary Surveillance Radars (SSRs) are typically less than the effects on PSRs but can be caused due to the physical blanking and diffracting effects of the turbine towers, dependent on the size of the WTGs and wind farm. CAP 764 states *"These effects are typically only a consideration when the turbines are located very close to the SSR i.e., less than 10 km."*. Furthermore, NATS do not consider the impact of WTGs on SSRs to be material or relevant for turbines that are beyond approximately 28 km from their SSR facilities. The closest SSR to the Array Areas is Fitful Head, located 52.3 km to the southwest as displayed within Figure 14.3. The TOPA produced by NATS confirms that there should be no impact from the Offshore Proposed Development to Fitful Head.

14.4.4 Civil Aviation Receptors

In summary the Offshore Proposed Development Array Areas have the potential to impact Compass Head NERL PSR and IFPs at Sumburgh Airport.

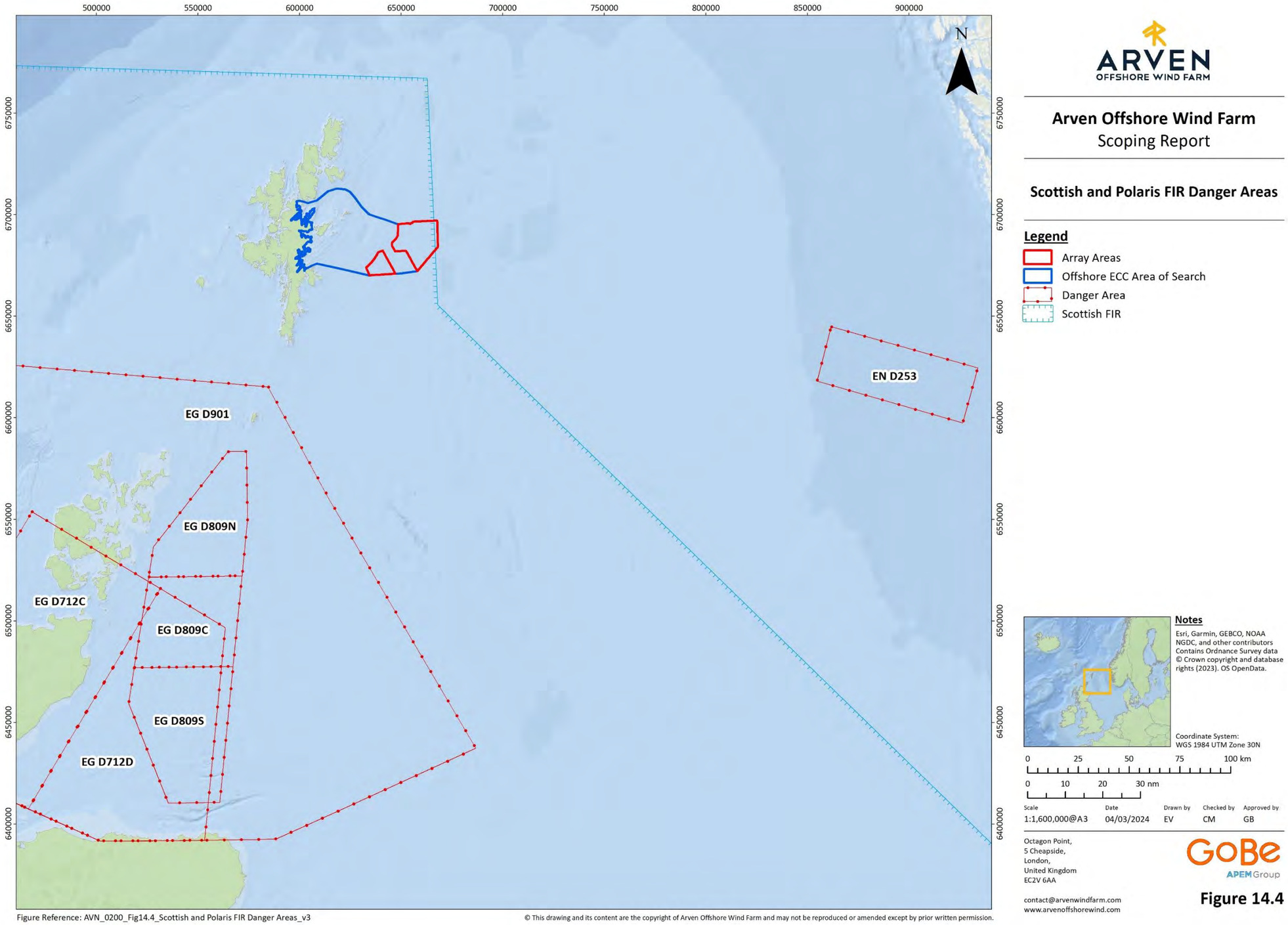
14.4.5 Military Airspace

The nearest military airspace to the Offshore Proposed Development Array Areas is the danger area EG D901 Fast Jet Area North, located 74.3 km to the southwest of the Array Areas. This airspace has a lower limit of FL 245 and an upper limit of FL 550 (approximately 24,500 ft and 55,000 ft AMSL respectively). Activity within this airspace includes high energy manoeuvres/ordnance, munitions and explosives.

The nearest danger area within Polaris FIR to the Array Areas is EN D253, located 197.1 km to the east southeast of the Array Areas. This airspace has a lower limit of sea level, and an upper limit of FL 460 (approximately 46,500 ft AMSL).

The applicant has requested pre-application advice from the MoD regarding the Offshore Proposed Development. The Defence Infrastructure Organisation (DIO) has represented the MoD and highlighted concerns regarding the development. Within this response the DIO state that WTGs with a tip height of 347.08 m amsl will impact on military low flying operations. The MoD will request that the WTGs be fitted with MoD accredited visible or infrared safety lighting.

There are no known further PEXAs, including non-aviation activities within the study area. All airspace mentioned above are depicted within Figure 14.4.



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Scottish and Polaris FIR Danger Areas

Legend
- Array Areas
- Offshore ECC Area of Search
- Danger Area
- Scottish FIR

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Figure 14.4

Figure Reference: AVN_0200_Fig14.4_Scottish and Polaris FIR Danger Areas_v3

Figure 14.4: Scottish and Polaris FIR Danger Areas

14.4.6 Military Radar

The nearest military AD radar to the Offshore Proposed Development Array Areas is Saxa Vord, located 58.9 km to the northwest of the Array Areas. Preliminary RLoS analysis indicates that WTGs with a maximum tip height of 361.19 m AMSL within the Array Areas will be fully visible, and WTGs will be visible across the western extent of the Array Areas. Saxa Vord RLoS is displayed within Figure 14.5.

The applicant has requested pre-application advice from the MoD regarding the Offshore Proposed Development. The Defence Infrastructure Organisation (DIO) has represented the MoD and highlighted concerns regarding the development. Within this response the DIO state that turbines with a tip height of 347.08 m amsl will be detectable by the Saxa Vord AD radar, which will result in the desensitisation of the radar in the vicinity, increase the false alarm rate, and reduce probability of detection.

The nearest military AD radar on UK mainland is Buchan, located 307.8 km to the south of the Array Areas. Preliminary RLoS analysis indicates that WTGs with a maximum tip height of 361.19 m AMSL within the Offshore Proposed Development Array Areas will not be visible to Buchan. Buchan RLoS is displayed in Figure 14.6.

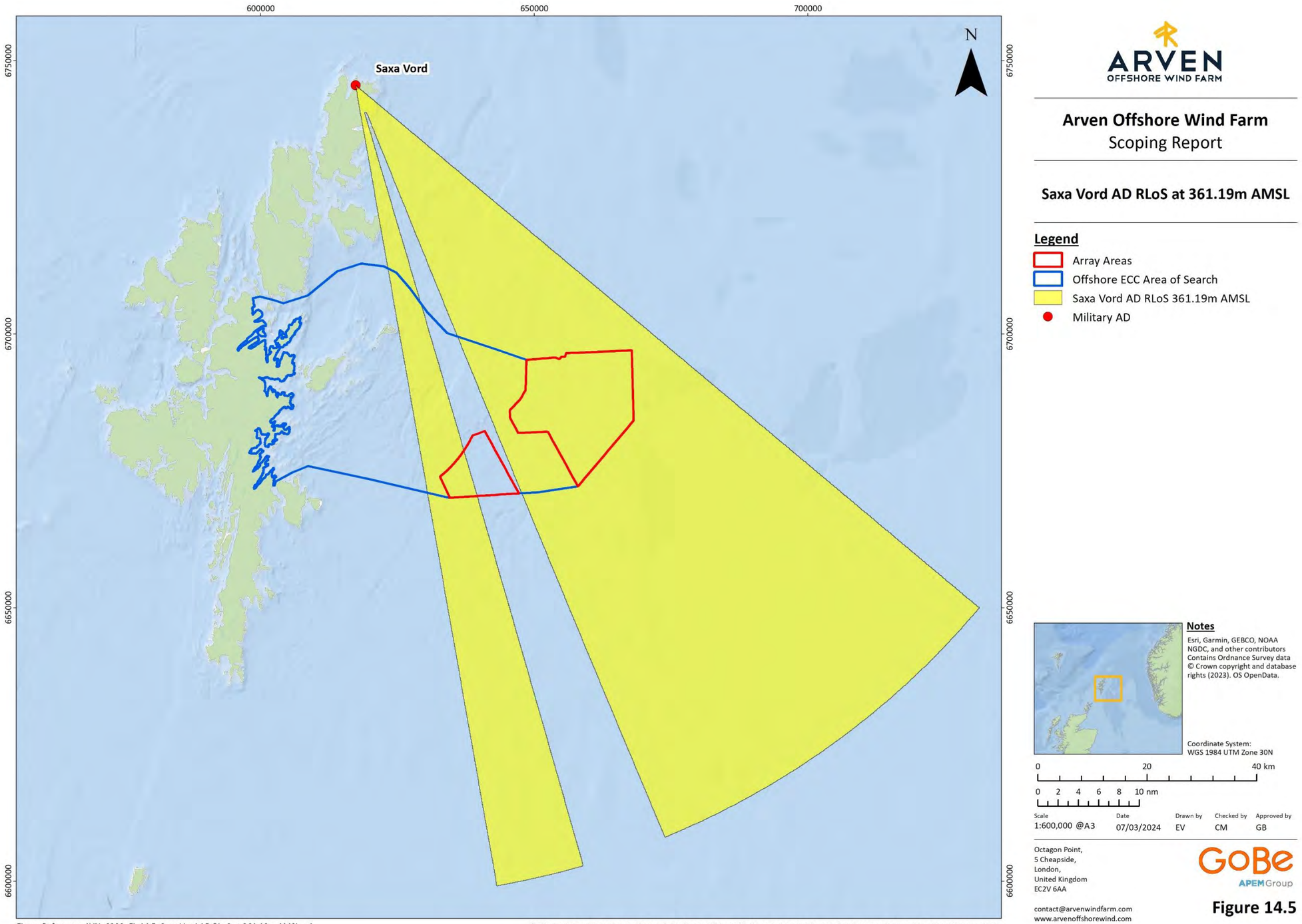
The closest radar equipped military airfield to the Offshore Proposed Development Array Areas is Royal Air Force (RAF) Lossiemouth, located 313.8 km to the southwest of the Array Areas. Preliminary RLoS analysis indicates that WTGs with a maximum tip height of 361.19 m AMSL within the Offshore Proposed Development Array Areas will not be visible to RAF Lossiemouth. Lossiemouth RLoS is displayed in Figure 14.6.

14.4.7 Military Receptors

In summary, WTGs within the Offshore Proposed Development Array Areas have the potential to impact the Saxa Vord AD radar.

14.4.8 Meteorological Radio Facilities

The closest Met Office weather radar to the Offshore Proposed Development Array Areas is the Hill of Dudwick. The Hill of Dudwick is located 314 km to the southeast of the Array Areas. Preliminary RLoS analysis confirms that WTGs with a maximum tip height of 361.19 m AMSL within the Offshore Proposed Development Array Areas will not be visible to the Hill of Dudwick. Hill of Dudwick RLoS is displayed in Figure 14.7.



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Saxa Vord AD RLoS at 361.19m AMSL

Legend
- Array Areas
- Offshore ECC Area of Search
- Saxa Vord AD RLoS 361.19m AMSL
- Military AD

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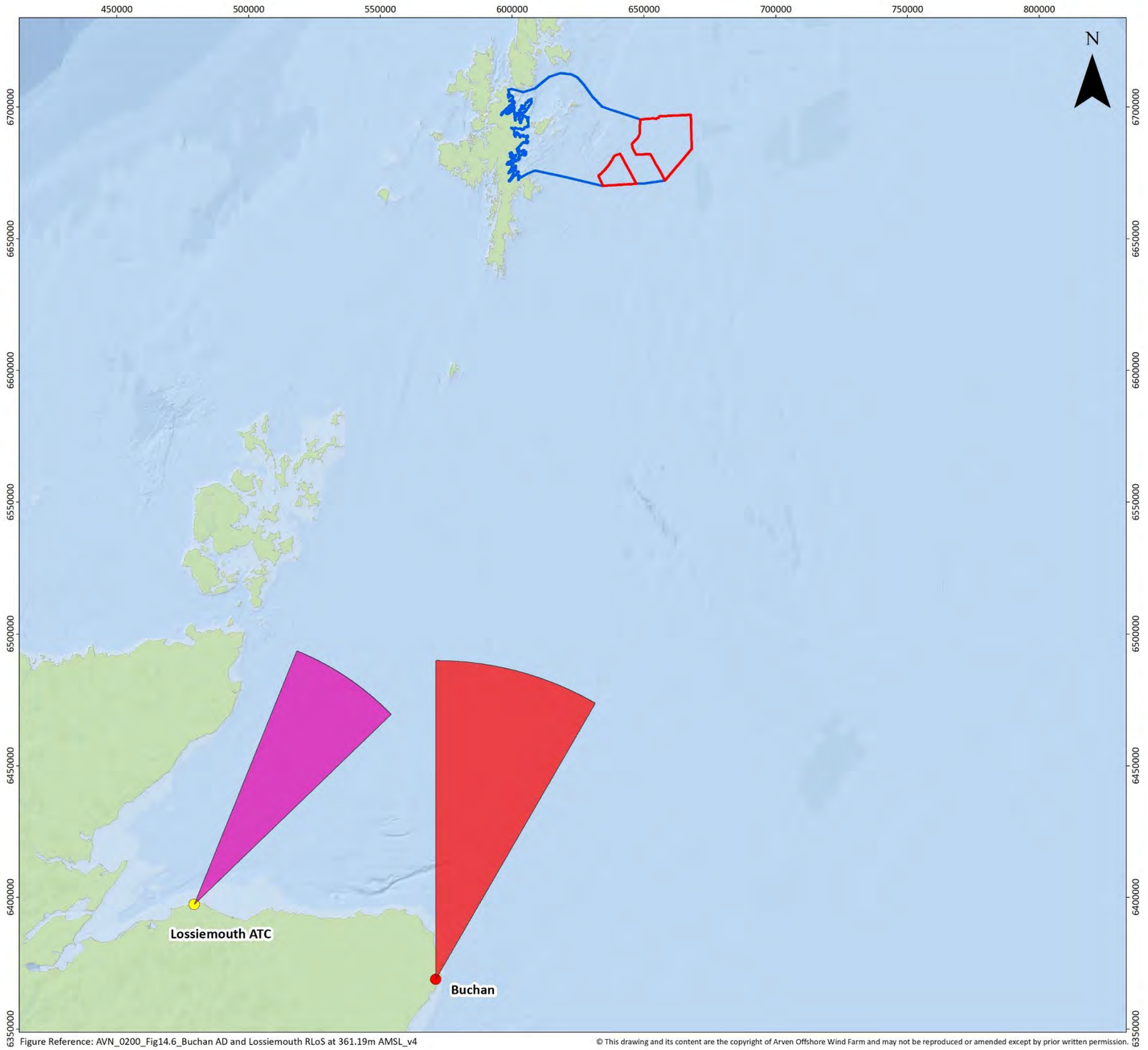
Figure 14.5

Figure Reference: AVN_0200_Fig14.5_Saxa Vord AD RLoS at 361.19m AMSL_v4

Figure 14.5: Saxa Vord AD RLoS at 361.19 m AMSL



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Buchan AD and Lossiemouth RLoS at 361.19m AMSL

Legend

- Array Areas
- Offshore ECC Area of Search
- Buchan AD RLoS 361.19m AMSL
- Lossiemouth ATC RLoS 361.19m AMSL
- Military AD
- Military ATC Radars

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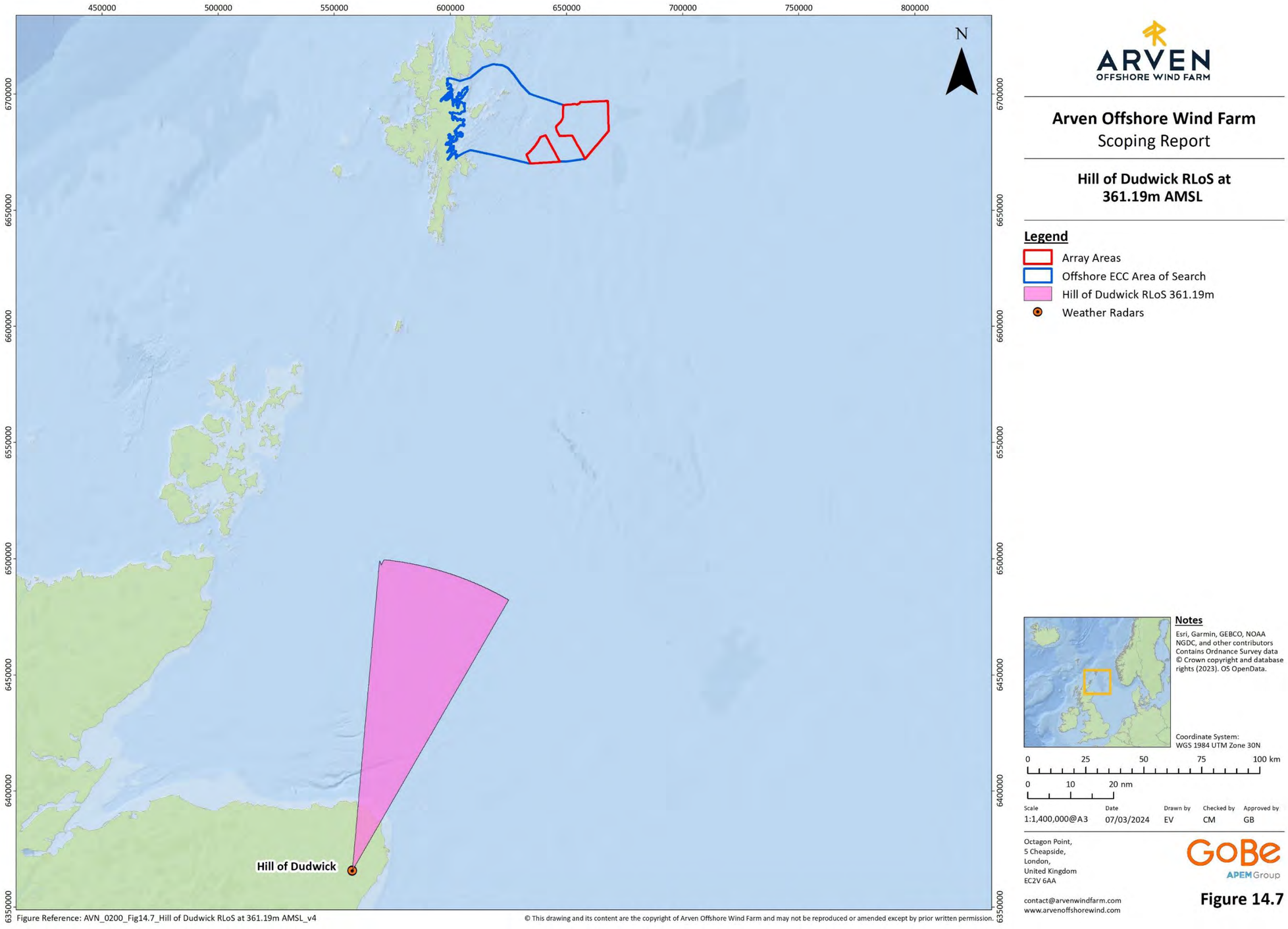
Figure 14.6

Figure Reference: AVN_0200_Fig14.6_Buchan AD and Lossiemouth RLoS at 361.19m AMSL_v4

Figure 14.6: Buchan AD and Lossiemouth RLoS at 361.19 m AMSL



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Hill of Dudwick RLoS at 361.19m AMSL

Legend

- Array Areas
- Offshore ECC Area of Search
- Hill of Dudwick RLoS 361.19m
- Weather Radars

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Figure 14.7

Figure Reference: AVN_0200_Fig14.7_Hill of Dudwick RLoS at 361.19m AMSL_v4

Figure 14.7: Hill of Dudwick RLoS at 361.19 m AMSL

14.4.9 Space Port

SaxaVord Spaceport is developing a launch site and ground station at Lamba Ness in Unst, Shetland. The development is understood to encompass three rocket launch pads on Lamba Ness peninsula with additional infrastructure such as a satellite tracking facility, rocket hangars and integration facilities. The Spaceport is understood to have a licence allowing up to 30 launches per year.

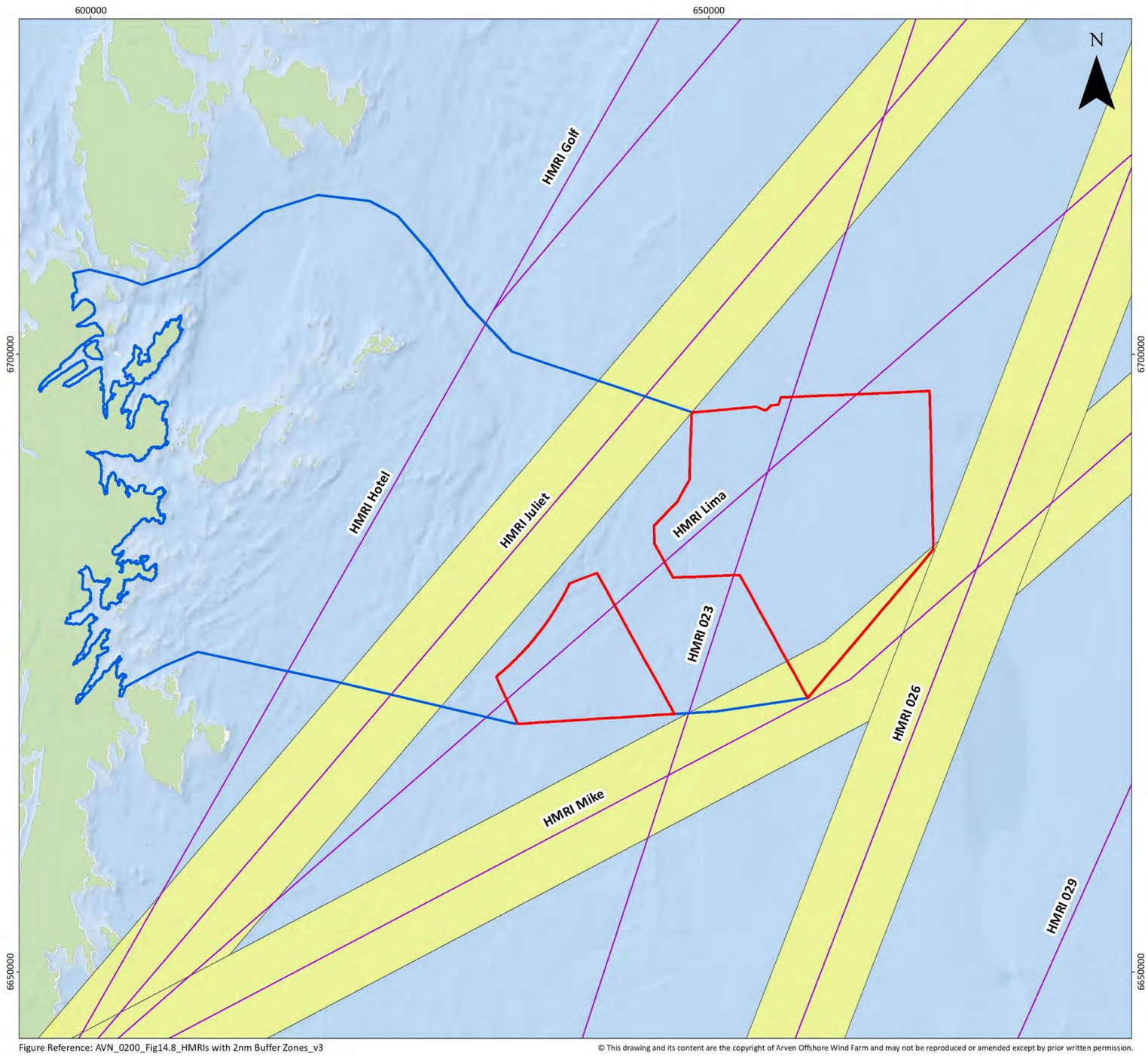
14.4.10 Helicopter Main Routing Indicators

The Array Areas are within the vicinity of the East Shetland Basin, a major oil-producing area within the North Sea. The North Sea contains a network of offshore routes that are flown by helicopters in support of oil and gas installations. These routes are published on charts as Helicopter Main Routing Indicators (HMRIs) and alert other airspace users of the potential for frequent low-level helicopter traffic. The routes have no lateral dimensions, however there should be no obstacles within a 2 nm of the route centreline.

The centrelines of HMRIs Lima and 023 cross the Offshore proposed Development Array Areas. Furthermore, the Array Areas are within 2 nm of the centreline for HMRI Mike. HMRIs and the 2 nm buffer zones are displayed within Figure 14.8.

14.4.11 Offshore Helidecks

To help achieve a safe operating environment, a 9 nm consultation zone for planned obstacles exists around offshore helicopter destinations. Within 9 nm, obstacles such as WTGs can potentially impact upon the feasibility of helicopters to safely fly low visibility or missed approach procedures at the associated helideck site. There are no offshore helidecks within a 9 nm range of the Offshore Proposed Development Array Areas, the closest offshore helideck is the Kraken Floating Production, Storage and Offloading (FPSO), located 79.7 km to the southeast of the Array Areas.



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HMRIs with 2nm Bufer Zones

Legend
- Array Areas
- Offshore ECC Area of Search
- HMRI 2nm Buffer Zones
- HMRI

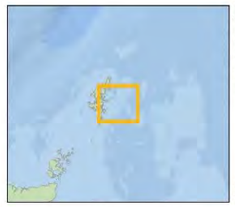

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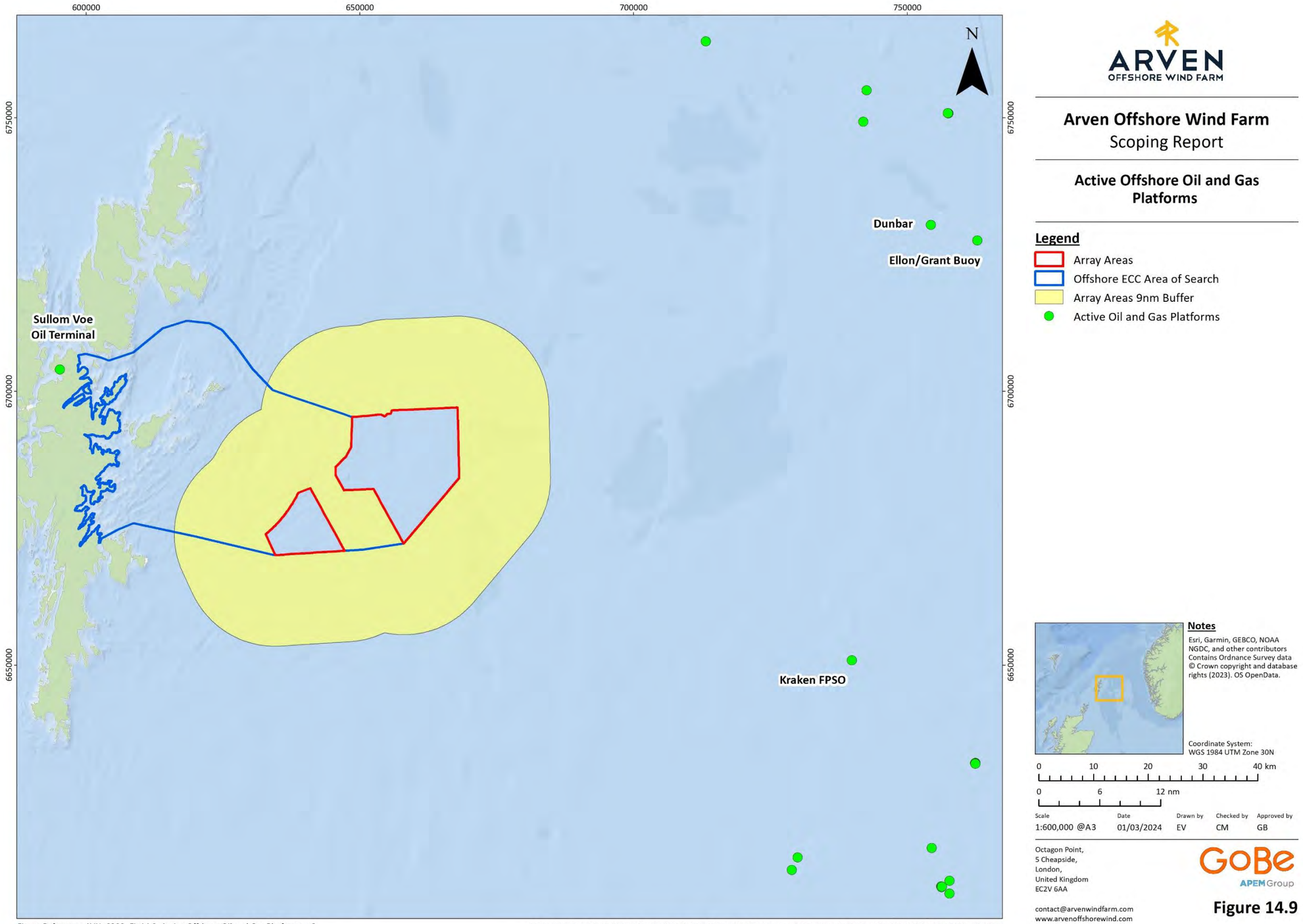
Figure 14.8

Figure Reference: AVN_0200_Fig14.8_HMRIs with 2nm Buffer Zones_v3

Figure 14.8: HMRIs with 2 nm Buffer Zones



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Active Offshore Oil and Gas Platforms

Legend
- Array Areas
- Offshore ECC Area of Search
- Array Areas 9nm Buffer
- Active Oil and Gas Platforms

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Figure 14.9

Figure Reference: AVN_0200_Fig14.9_Active Offshore Oil and Gas Platforms_v3

Figure 14.9: Active Offshore Oil and Gas Platforms.

14.4.12 Search and Rescue

Bristow Group currently supply the helicopters used in SAR operations in the vicinity of the Offshore Proposed Development Array Areas. There are ten SAR helicopter bases in the UK. The nearest SAR helicopter base to the Offshore Proposed Development Array Areas is at Sumburgh Airport, 49.7 km to the southwest of the Array Areas. For SAR operations to be carried out safely and efficiently, they require developers to fulfil WTGs spacing, marking, and lighting requirements as set out by the MCA.

14.5 Embedded Mitigation

As part of the initial design process, embedded mitigation measures are proposed to reduce the potential environmental effects of development. Measures related to Aviation and Radar are as follows:

- C-16: Development and adherence to an LMP. The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.
- C-18: Development and adherence to an ERCoP. The ERCoP will be prepared in line with MCA guidance and confirms what measures the Project has in place to support any emergency response.
- C-33: Compliance with MCA Marine Guidance Note (MGN) 654 (MCA, 2021) and its annexes where applicable. Also MGN 543 SAR annex 5 (MCA, 2018).
- C-34: Appropriate marking of the Project on Admiralty and aeronautical charts. This will involve provision of the positions and heights of structures to the UKHO, UK CAA, CAA Norway, MOD, and Defence Geographic Centre (DGC).
- C-38: Aviation lighting and marking, as described in the LMP, will be installed in accordance with Article 223 of the UK Air Navigation Order (ANO) 2016 and Civil Aviation Publication 168which sets out the mandatory requirements to be followed for lighting of offshore WTGs.
- C-39: The layout of the Project, as presented in the DSLP, will be finalised in discussion with the MCA and the NLB to ensure the specific turbine layout is compatible with potential SAR activity.
- C-40: Failures to Project lighting and marking requirements will be appropriately reported and rectified as soon as practicable. Interim hazard warnings will be put in place as required.

As a result of the commitment to implement these measures, and to align the Offshore Proposed Development with various standard sectoral processes, the embedded commitments are considered inherently part of the design of the Offshore Proposed Development and have therefore been included within the assessment presented in section 14.6. The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon aviation and radar and will be consulted on with statutory consultees throughout the EIA process.

14.6 Scoping of Impacts

14.6.1 Potential Impacts scoped in

Table 14.2 sets out an initial assessment of the likelihood of effects on Aviation and Radar due to the Offshore Proposed Development activities scoped in for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the Offshore Proposed Development at the scoping stage; embedded commitments; the level of understanding of the baseline at the scoping stage; the existing evidence base for Aviation and Radar effects due to Offshore Proposed Development activities; relevant policy; and the professional judgement of qualified Aviation and Radar specialists.

Table 14.2: Impacts scoped into the assessment of Aviation and Radar

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction			
Creation of an aviation obstacle environment	Construction and decommissioning of the wind farm may involve tall crane vessels creating a physical obstruction. The presence of WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs and associated obstructions will have a potential impact on military low flying aircraft, Sumburgh Airport IFPs, helicopter traffic in support of offshore oil and gas, and SAR operations.	An IFP assessment will be necessary to determine if the Offshore Proposed Development will impact Sumburgh Airport IFPs.	C-16 (LMP), C-18 (ERCoP), C-33 (Compliance with MCA MGN), C-34 (Marking of Project on charts), C-38 (Lighting and Marking in accordance with ANO), C-39 (Layout to be finalised with NLB & MCA, and C-40.
Increased air traffic in the area related to wind farm activities	Helicopter traffic involved in all stages of the Project could affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing traffic will include low flying aircraft and helicopters in support of the oil and gas industry.		C-16 (LMP), C-18 (ERCoP), C-33 (Compliance with MCA MGN), C-34 (Marking of Project on charts), C-38 (Lighting and Marking in accordance with ANO), C-39 (Layout to be finalised with NLB & MCA, and C-40.
Effect on civil and military PSR systems	To discriminate between aircraft targets and clutter, PSRs ignore static objects and only display moving targets. PSRs that can see rotating blades of WTGs can mistake	Consultation with the MOD, NATS and HIAL is necessary to ascertain	n/a

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from clutter. This is only applicable when WTGs begin rotation. Tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter. WTGs will be gradually commissioned during the construction phase. Effects on civil and military PSR systems is scoped out of the construction period prior to first energy. Specifically, WTGs within the Offshore Proposed Development Array Areas have the potential to impact the Saxa Vord AD radar and the NATS operated radar, Compass Head.	mitigation options if applicable.	
Transboundary impact	The Array Areas infringe Polaris FIR airspace regulated by CAA Norway.	Consultation with CAA Norway will determine the extent of the transboundary impact the Project will have at all stages.	C-34 (Marking of Project on charts),
Operation and Maintenance			
Creation of an aviation obstacle environment	Construction and decommissioning of the wind farm may involve tall crane vessels creating a physical obstruction.	An IFP assessment will be necessary to determine if	. C-16 (LMP), C-18 (ERCoP), C-33 (Compliance with MCA

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	The presence of WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs and associated obstructions will have a potential impact on military low flying aircraft, Sumburgh Airport IFPs, helicopter traffic in support of offshore oil and gas, and SAR operations.	the Offshore Proposed Development will impact Sumburgh Airport IFPs.	MGN), C-34 (Marking of Project on charts), C-38 (Lighting and Marking in accordance with ANO), C-39 (Layout to be finalised with NLB & MCA, and C-40.
Increased air traffic in the area related to wind farm activities	Helicopter traffic involved in all stages of the Project could affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing traffic will include low flying aircraft and helicopters in support of the oil and gas industry.		C-16 (LMP), C-18 (ERCoP), C-33 (Compliance with MCA MGN), C-34 (Marking of Project on charts), C-38 (Lighting and Marking in accordance with ANO), C-39 (Layout to be finalised with NLB & MCA, and C-40..
Effect on civil and military PSR systems	To discriminate between aircraft targets and clutter, PSRs ignore static objects and only display moving targets. PSRs that can see rotating blades of WTGs can mistake them for aircraft and so present them on ATC radar displays as clutter.	Consultation with the MOD, NATS and HIAL is necessary to ascertain mitigation options if applicable.	n/a

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	Controllers may not be able to distinguish aircraft from clutter. This is only applicable when WTGs begin rotation. Tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter. WTGs will be gradually commissioned during the construction phase. Effects on civil and military PSR systems is scoped out of the construction period prior to first energy. Specifically, WTGs within the Offshore Proposed Development Array Areas have the potential to impact the Saxa Vord AD radar and the NATS operated radar, Compass Head.		
Transboundary impact	The Array Areas infringe Polaris FIR airspace regulated by CAA Norway.	Consultation with CAA Norway will determine the extent of the transboundary impact the Project will have at all stages.	C-34 (Marking of Project on charts)
Decommissioning			
Creation of an aviation obstacle environment	Construction and decommissioning of the wind farm may involve tall crane vessels creating a physical obstruction. The presence of WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or	An IFP assessment will be necessary to determine if the Offshore Proposed	C-16 (LMP), C-18 (ERCoP), C-33 (Compliance with MCA MGN), C-34 (Marking of Project on charts), C-38 (Lighting and Marking in

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs and associated obstructions will have a potential impact on military low flying aircraft, Sumburgh Airport IFPs, helicopter traffic in support of offshore oil and gas, and SAR operations.	Development will impact Sumburgh Airport IFPs.	accordance with ANO), C-39 (Layout to be finalised with NLB & MCA, and C-40.
Increased air traffic in the area related to wind farm activities	Helicopter traffic involved in all stages of the Project could affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing traffic will include low flying aircraft and helicopters in support of the oil and gas industry.		C-16 (LMP), C-18 (ERCoP), C-33 (Compliance with MCA MGN), C-34 (Marking of Project on charts), C-38 (Lighting and Marking in accordance with ANO), C-39 (Layout to be finalised with NLB & MCA, and C-40.
Transboundary impact	The Array Areas infringe Polaris FIR airspace regulated by CAA Norway.	Consultation with CAA Norway will determine the extent of the transboundary impact the Project will have at all stages.	C-34 (Marking of Project on charts)

14.6.2 Potential Impacts scoped out

Table 14.3 lists the impacts which can be scoped out at the scoping stage of the EIA process.

Table 14.3: Impacts proposed to be scoped out of further assessment for Aviation and Radar

Impact	Justification
Construction, Operation and Maintenance, and Decommissioning.	
Effects on civil and military SSR systems	CAP 764 states that the effects on SSR *"…are typically only a consideration when the turbines are located very close to the SSR i.e., less than 10 km"*. The nearest SSR facility is located at Fitful Head, 52.3 km to the southwest of the Array Areas. NATS do not consider the effects of WTGs on SSR to be material or relevant for WTGs that are beyond approximately 28 km from the nearest SSR facility.
Effects on weather radars	The nearest Met Office Radar is the Hill of Dudwick, located 314 km from the closest extent of the Array Areas. Preliminary RLoS analysis indicates that WTGs with a maximum tip height of 361.19 m AMSL within the Offshore Proposed Development Array Areas will not be visible to the Hill of Dudwick.

14.7 Potential Cumulative Impacts

The process by which potential cumulative impacts will be assessed through the CIA is described in Chapter 4: EIA Methodology. Aviation and Radar impacts will potentially occur where there are other planned/proposed OWFs in developments in close proximity to the Offshore Proposed Development, along with associated aviation activities. There is a ScotWind OWF in the pre-planning phase of development located 5.1 km to the north of the Array Areas, known as Stoura Offshore Wind Farm.

14.8 Potential Transboundary Impacts

The process by which potential transboundary impacts will be assessed is described in Chapter 4: EIA Methodology.

The east of the Array Areas infringes the Polaris FIR. Although the Array Areas do not infringe controlled Airspace within the Polaris FIR, consultation will be necessary with CAA Norway to determine the extent of the transboundary impacts caused by activities associated with the project. CAA Norway will need to be notified of any obstruction and increased air traffic during all phases of the project.

14.9 Proposed Approach to EIA

14.9.1 Relevant Guidance

The assessment of Aviation and Radar receptors will also comply with the following guidance documents where they are specific to the topic:

- Norway eAIP (CAA Norway, 2023a)
- Regulations relating to reporting, registration and marking of obstacles to aviation (CAA Norway, 2023b)
- CAP 032 UK AIP (CAA, 2023a);
- CAP 168 Licensing of Aerodromes (CAA, 2022);
- CAP 1616 Airspace Change (CAA, 2023b);
- CAP 437 Standards for Offshore Helicopter Landing Areas (CAA 2023c);
- CAP 670 Air Traffic Services Safety Requirements (CAA, 2019);
- CAP 764 Policy and Guidance on Wind Turbines (CAA, 2016);
- International Civil Aviation Organisation (ICAO) Annex 14 Aerodrome Design and Operations (ICAO, 2022);
- MCA Document Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for SAR and Emergency Response (MCA, 2021a);
- MCA MGN 654 Safety of Navigation: OREIs – Guidance and Operational Considerations for SAR and Emergency Response (MCA, 2021b);
- MoD Obstruction and Lighting Guidance (Low Flying Operations Flight, 2020); and
- UK Military AIP (MoD 2023).

14.9.2 Anticipated Additional Data Sources at EIA

A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report.

14.9.3 Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report.

The EIA process will be supported by further desk-based studies, including RLoS modelling, that will identify and examine in greater detail sensitive aviation and radar receptors. RLoS is determined using radar propagation modelling software and 3D terrain data. Studies will be undertaken in parallel with consultation with relevant stakeholders to provide a detailed understanding of potential impacts. It is expected that consultation will be an iterative process, allowing for any concerns that are raised to be considered throughout the pre-application phase and in finalising the consent application. The Aviation and Radar assessment will comply with the guidance documents listed in Section 14.9.1.

14.10 Scoping Questions

The following scoping questions refer to the aviation and Radar chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area defined in Section 14.2?

- Do you agree with the use of those data listed in Section 14.3, and any additional anticipated data listed in Section 14.9, being used to inform the Offshore EIA?
- Do you agree that all receptors related to Aviation and Radar have been identified?
- Do you agree with the proposed study areas identified for the Aviation and Radar receptors?
- Do you agree with the scoping in and out of impacts related to Aviation and Radar?
- Do you agree with the assessment of transboundary effects related to Aviation and Radar?
- Do you agree with the assessment of cumulative effects related to Aviation and Radar?
- Do you agree with the proposed assessment methodology related to Aviation and Radar?

15 Shipping and Navigation

15.1 Introduction

This chapter of the Offshore Scoping Report identifies the potential impacts of relevance to Shipping and Navigation from the construction, O&M, and decommissioning of the Offshore Proposed Development. This chapter provides an overview of the existing environment and sets out the proposed methodology and approach to assessing effects on Shipping and Navigation receptors. This also includes the impacts on SAR.

The output of the scoping process will feed into the Navigational Risk Assessment (NRA) which will be produced in sole support of the EIA process.

This chapter and the NRA should be read in conjunction with the following linked and supporting offshore chapters:

- Chapter 13: Commercial Fisheries;
- Chapter 14: Aviation and Radar; and
- Chapter 17: Other Marine Users and Infrastructure.

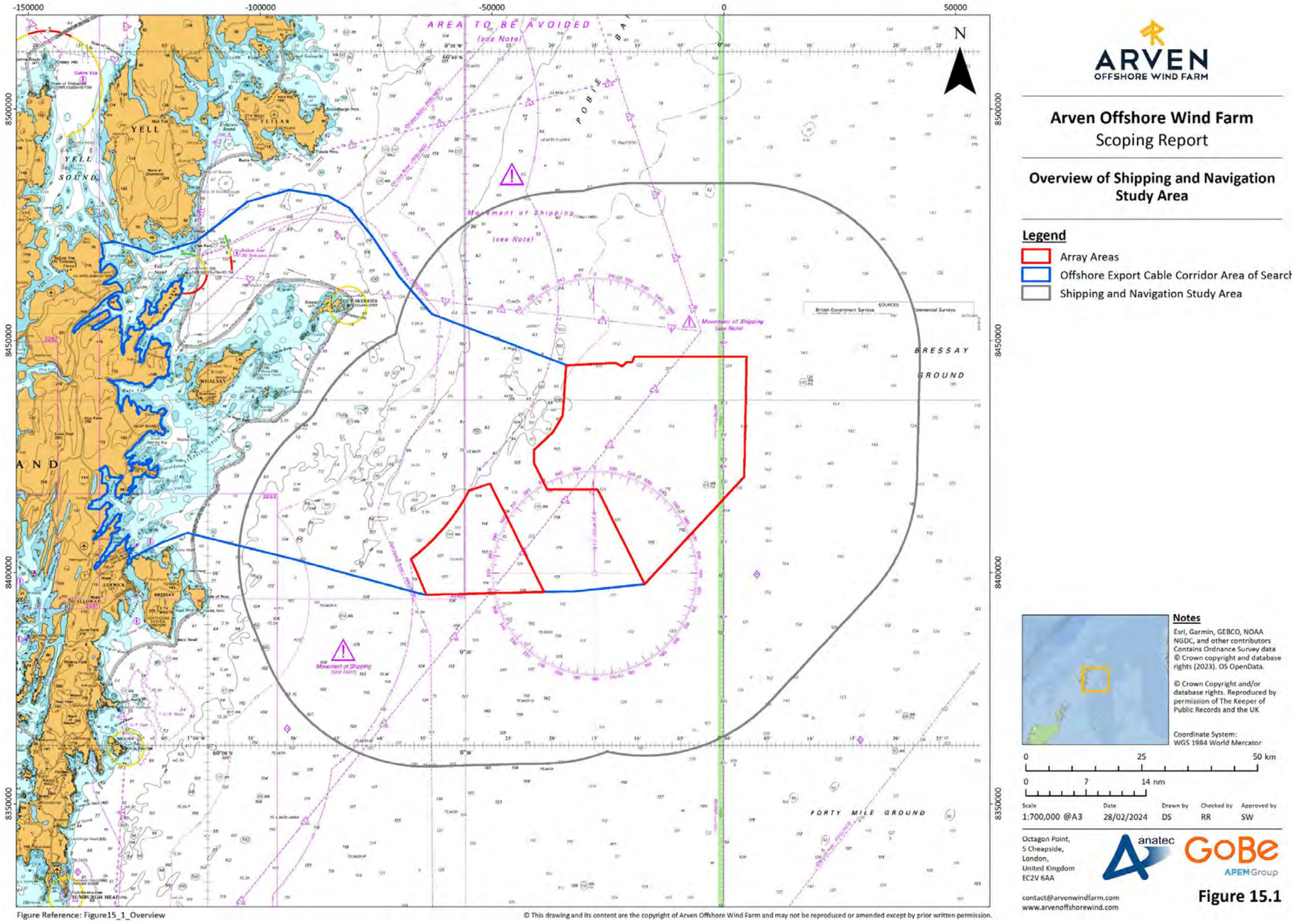
With regards to commercial fishing, this chapter considers hazards to commercial fishing vessels i.e., impacts associated with navigational safety. Other impacts are considered in Chapter 13: Commercial Fisheries.

This chapter of the Offshore Scoping Report has been prepared by Anatec Limited.

15.2 Study Area

The Shipping and Navigation study area has been defined as 10 nm around the Array Areas. The 10 nm study area is standard for Shipping and Navigation assessments as it is large enough to encompass any vessel routeing which may be impacted, while remaining site specific to the area being studied. The Shipping and Navigation study area is shown in Figure 15.1.

A separate study area for the OfECC will be assessed in the NRA as a part of the EIAR, likely consisting of a 2 nm buffer around a refined corridor located within the current area of search. The OfECC is anticipated to make landfall on the east coast of Mainland, Shetland as illustrated by the OfECC Study Area in Figure 15.1. The Shipping and Navigation OfECC Study Area will cover navigable waters between MLWS and the boundary of the Array Areas.



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Overview of Shipping and Navigation Study Area

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Shipping and Navigation Study Area

Notes

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Figure 15.1

Figure Reference: Figure15_1_Overview

Figure 15.1: Overview of Shipping and Navigation Study Area

15.3 Data Sources at Scoping

The data sources that have been used to inform this chapter are presented within Table 15.1. These data sources will be taken forward and used to inform the NRA, alongside additional site-specific data that will be collected for the Offshore Proposed Development.

Table 15.1: Data sources used to inform the Shipping and Navigation scoping chapter

Title	Summary	Source	Author and year
28-Day AIS data collected from coastal receivers from 01–14 February 2023 and 01–14 August 2023	Provides movements of vessels broadcasting on AIS within the Shipping and Navigation study area. Vessels which are not required to carry AIS mandatorily may be underrepresented. In particular, vessels under 300 gross tonnage (GT), commercial fishing vessels under 15 metres (m) length and recreational vessels are not required to, and so may not broadcast information on AIS, unless doing so voluntarily.	Anatec Ltd.	Anatec Ltd, 2023
UKHO Admiralty Charts 1119, 1233, 3270, 3282, 3283, 3284, 3292, and 3298	Provides an overview of navigational features located in proximity to the Offshore Proposed Development.	UKHO	UKHO, 2023
Incident data provided by the RNLI	Provides details and locations of incidents reported by the RNLI over a 10-year period.	RNLI	RNLI, 2013-2022
Incident data provided by the Marine Accident Investigation Branch (MAIB)	Provides details and locations of incidents reported by the MAIB over a 10-year period.	MAIB	MAIB, 2012-2021
UKHO Admiralty Sailing Directions North Coast of Scotland Pilot NP52 11th Edition	Pilot book providing essential information to support port entry and coastal navigation for vessels including navigational hazards, buoyage, pilotage, regulations, general notes on countries, port facilities, seasonal currents, ice, and climatic conditions.	UKHO	UKHO, 2021

15.4 Baseline Environment

This section is focused on the Array Areas noting a full assessment for Shipping and Navigation will be carried out within the NRA for the Array Areas and the OfECC. Any navigational features of importance to the Offshore Proposed Development that are located within the OfECC Study Area have been highlighted in Section 15.4.1.

15.4.1 Navigational Features

Navigational charts and Admiralty Sailing Directions pertinent to the Offshore Proposed Development were studied to define charted features or key navigational practices. The key navigational features are presented in Figure 15.2, noting all navigational features relevant to Shipping and Navigation will be detailed within the NRA.

The only navigational features that are present within the Array Areas include the eastern boundary line of the West European Tanker Reporting System (WETREP) which intersects the Northeast of the Array Areas, and as illustrated in Figure 15.2, is inclusive of all sea area to the west of the boundary line. The WETREP is a mandatory vessel reporting system under the International Convention for the Safety of Life at Sea (SOLAS) regulation V/11 established in the Western European Particularly Sensitive Sea Area, and as noted on nautical charts "*Tankers of more than 600 dead weight tonnage (DWT) carrying heavy crude oil, heavy fuel oil or bitumen and tar and their emulsions are required to participate in the WETREP"* (UKHO, 2023).

Intersecting the Array Areas is the eastern boundary of the precautionary area relating to the movement of shipping. It is advised by nautical charts and Admiralty Sailing Directions that vessels navigating on approach to Lerwick should do so with caution as "*large deep-draught vessels with limited maneuverability may be encountered"* as well as "*Laden tankers with low freeboard may not be clearly visible in poor weather"* along with *"Large structures or vessels under tow may be encountered"* (UKHO, 2022).

Other key navigational features of relevance to the Offshore Proposed Development include Lerwick Harbour, approximately 16 nm to the west of the south western point of the Array Areas. Lerwick Harbour is the most northernly commercial harbour in the UK and the only commercial harbour on the east of the Shetland Islands and is operated by Lerwick Port Authority. Lerwick Harbour has two pilot boarding stations, one at each of the north and south approaches, with the northern station with the scoping boundary.

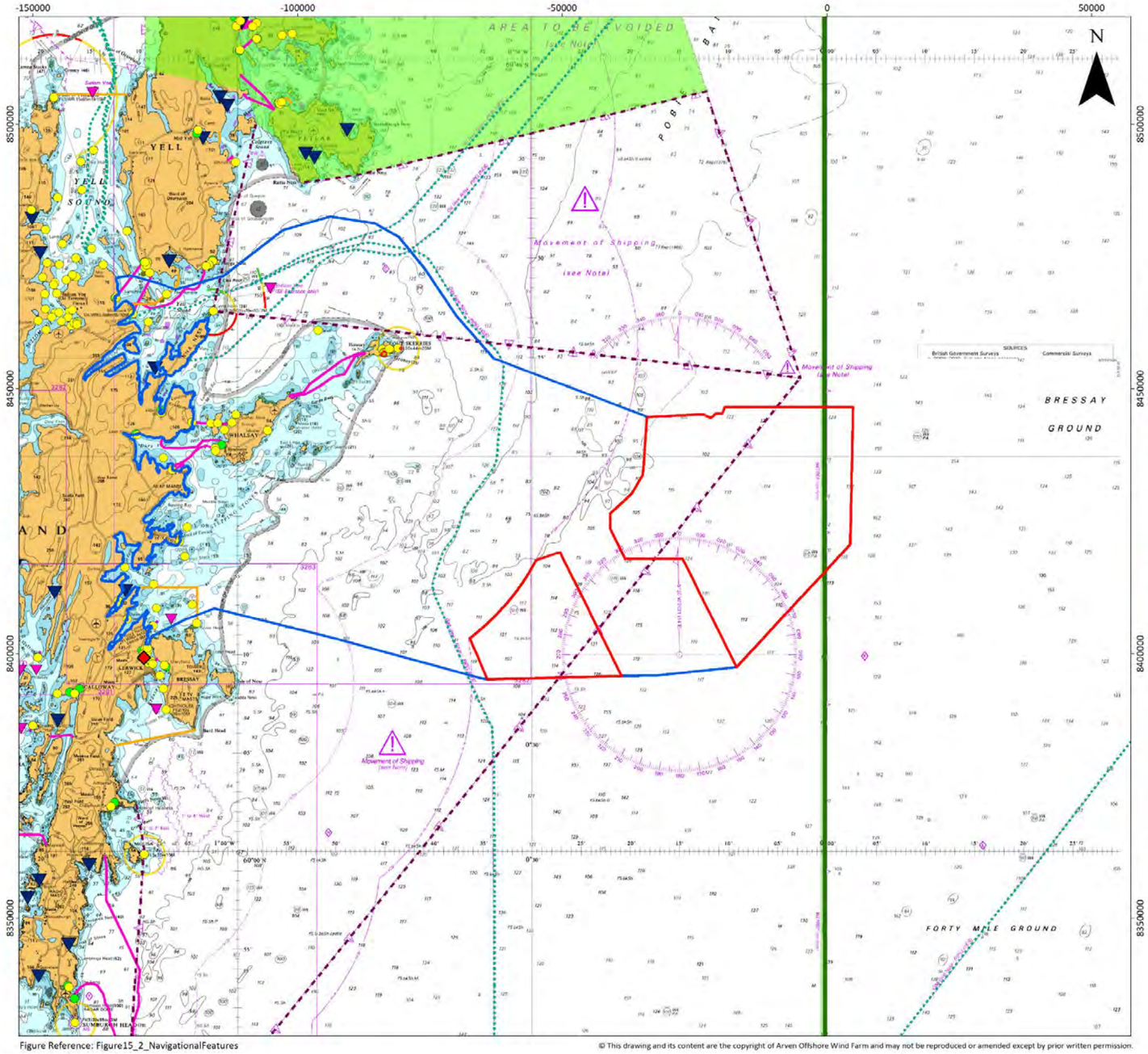
Several charted harbours and ferry terminals of navigation importance are noted within the scoping boundary including Symbister Bay on the Whalsay island, Out Skerries, and Vidlin and Laxo (both located on Mainland, Shetland). There are regular passenger ferry routes which operate between these locations, as well as to Lerwick, and would need to be considered as part as the NRA as may be lifeline routes.

Many aquaculture farms are present within the scoping boundary. As highlighted by the Admiralty Sailing Directions, farms are being added and removed on a continuous basis and positions may change frequently.

Several subsea cables are present within the scoping boundary connecting Mainland, Shetland to offshore islands with the closest cable over 14 nm from the closest point of the Array Areas. As for subsea pipelines, a

gas pipeline, part of the Shetland Island Regional Gas Export System, runs parallel at approximately 0.8 nm to the west of the southern point of the Array Areas which connects Shetland to mainland UK.

There is no oil and gas or offshore wind surface infrastructure in proximity to the Offshore Proposed Development.



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Key Navigational Features

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search

Navigational Features

- Lerwick Harbour
- Aid to Navigation
- Pilot Boarding Station
- Harbour/Marina/Ferry Terminal
- Anchor Point
- Harbour Limit
- WETREP Boundary
- Movement of Shipping Precautionary Area
- Subsea Pipeline
- Subsea Cable
- Area to be Avoided
- Restricted Area
- Aquaculture Farm
- Foul Ground
- Spoil Ground

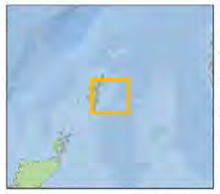

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Figure 15.2

Figure Reference: Figure15_2_NavigationalFeatures

Figure 15.2: Key Navigational Features

15.4.2 Vessel Traffic

An overview of the 28-day AIS vessel traffic data collected from coastal receivers from 01 to 14 February 2023 and 01 to 14 August 2023, colour-coded by vessel type, is illustrated in Figure 15.3. This data enables the key users to be identified. In summary, during the winter data period, there was an average of between 12 unique vessels per day recorded within the Shipping and Navigation study area. The busiest day for vessel traffic during the winter data period recorded 18 unique vessels while the quietest day recorded five unique vessels. The most common vessel types recorded were commercial fishing vessels (55%), oil and gas vessels (19%), and cargo vessels (16%). It is noted that no recreational vessels were recorded during the winter period.

During the summer data period there was an average of 17 unique vessels per day recorded within the Shipping and Navigation study area. The busiest day for vessel traffic during the summer data period recorded 27 unique vessels while the quietest day recorded nine unique vessels. The most common vessel types recorded were commercial fishing vessels (57%), oil and gas vessels (13%), and recreational vessels (12%). The presence of recreational vessels during the summer data period is expected due to the more favourable sailing conditions.

During both data periods combined, approximately 16% of all vessel tracks intersected the Array Areas, 78% of which were commercial fishing vessels.

Several commercial vessel routes were identified within the Shipping and Navigation study area. These routes include:

- Cargo vessels routeing Northwest-Southeast at the Northeast of the study area. These included one Roll-On/Roll-Off Cargo (RoRo) vessel operated by Smiryl Lines routeing to Torshavn (Faroe Islands) from Hirtshals (Denmark) once weekly. Container cargo and reefers were also utilising this route between Denmark and the Faroe Islands.
- Cargo vessels were also noted routeing Northeast-Southwest at the Southeast of the Shipping and Navigation study area between ports in Norway and ports in Ireland.
- One Roll-On/Roll-Off Passenger (RoPax) vessel was also on the same Torshavn – Hirtshals route to the northeast, also operated by Smiryl Lines, and passed twice weekly, once in each direction;
- Cruise liners were routeing to the south of the Array Areas to Lerwick (UK), but this was only recorded in the summer data period.
- Oil and gas vessels were routeing Northeast-Southwest to the north of the Array Areas between Lerwick and offshore oil and gas regions in the North Sea.
- Oil and gas vessels routeing between Aberdeen (UK) and offshore oil and gas regions were recorded both to the west and eastern extents of the Shipping and Navigation study area on a north-south bearing.

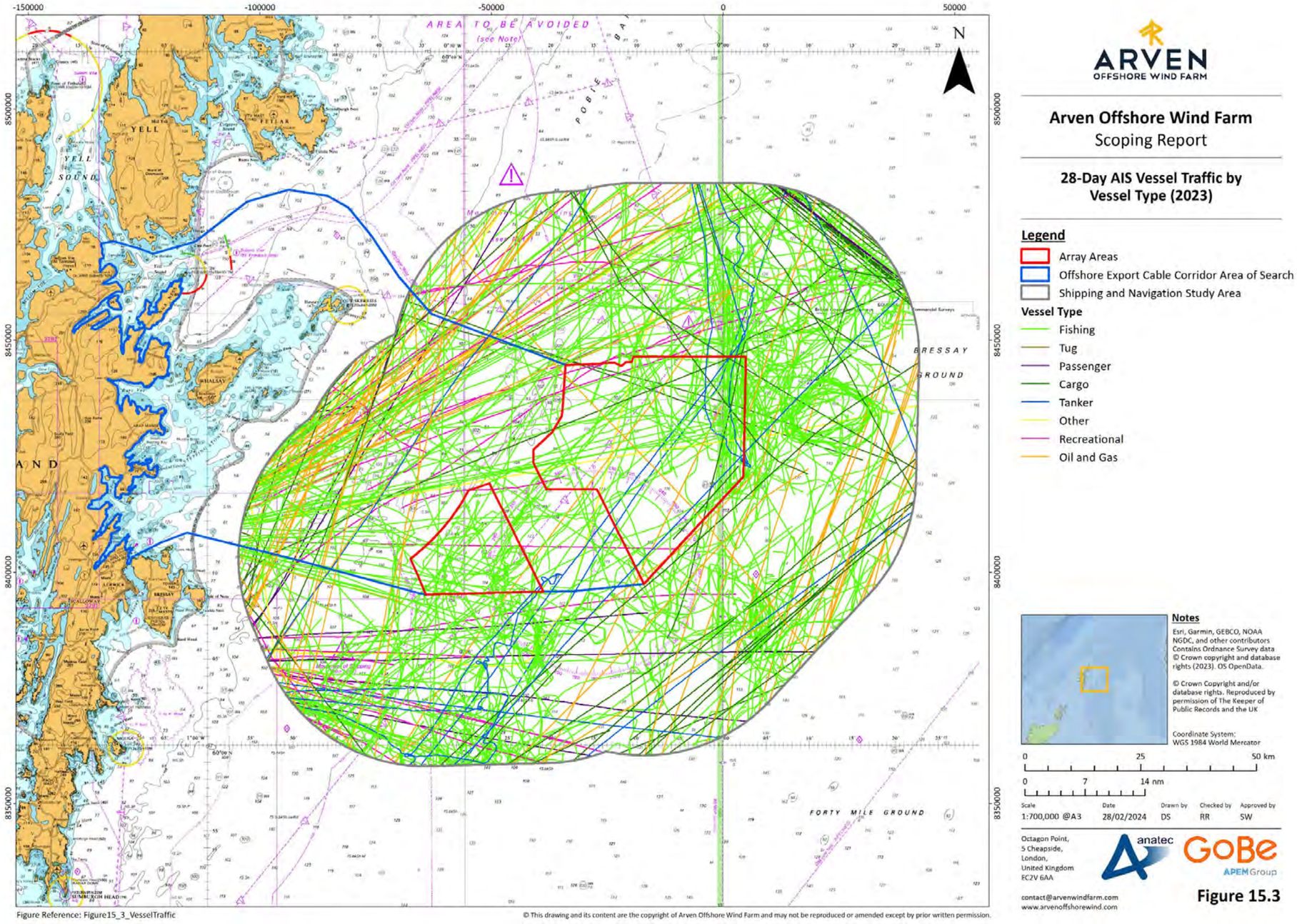
No tankers were recorded on defined routes within the Shipping and Navigation study area but three instances of tankers exhibiting ‘waiting’ behaviour were recorded, noting the Offshore Proposed Development is within the WETREP areas. Each instance was recorded by the same vessel on different days and was likely awaiting berth availability at Lerwick based on information broadcast via AIS.

Fishing vessels were the most recorded vessel type in both data periods and accounted for over half (54%) off all vessels recorded across the entire 28-days. Fishing vessels were recorded both on transit and likely engaged in active fishing. Active fishing can be determined by track speed, behaviour, and information

broadcast via AIS and will be fully detailed within the NRA. However, likely active fishing occurs within the southern and eastern extent of the Shipping and Navigation study area, including intersecting the Array Areas. Most vessels on transits were going to or from Lerwick. Recreational vessels were recorded on transit either to or from Lerwick or the south of Shetland.

Based on AIS navigational status programmed on the AIS transmitter, vessel speed, and individual track behavior, vessels can be identified as being at anchor and these will also be considered within the NRA.

As aforementioned, a detailed assessment of the OfECC will be included within the NRA. Although out with the Shipping and Navigation study area, passenger vessels and commercial ferries are noted within the OfECC study area to the west routeing to/from the Out Skerries island group.



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28-Day AIS Vessel Traffic by Vessel Type (2023)

Legend

- Array Areas
- Offshore Export Cable Corridor Area of Search
- Shipping and Navigation Study Area

Vessel Type

- Fishing
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Recreational
- Oil and Gas

Notes

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Figure 15.3

Figure Reference: Figure15_3_VesselTraffic

Figure 15.3: 28-Day AIS Vessel Traffic Data by Vessel Type (2023)

15.4.3 Marine Incident Data

15.4.3.1 Royal National Lifeboat Institution

RNLI data was reviewed for a 10-year period between 2013-2022. Seven incidents were recorded within the Shipping and Navigation study area. All incidents were within the west of the Shipping and Navigation study area with no reported incidents occurring within the Array Areas. Incidents consisted of five 'Machinery Failure', one 'Vessel May be in Trouble' and one 'Unspecified' incident. The casualty types of these incidents include three recreational vessels, three fishing vessels, and one vessel was unspecified. Lerwick RNLI station, approximately 16 nm west at the closest point of the Array Areas, responded to all incidents.

15.4.3.2 Maritime Accident Investigation Branch

MAIB data was reviewed for a 10-year period between 2012-2021. Five incidents were recorded within the Shipping and Navigation study area. No reported incidents occurred within the Array Areas. Incidents reported consisted of four "Hazardous Incident", two "Machinery Failure", and one "Flooding/Foundering" incidents. Vessel types involved in these incidents include four fishing trawlers, two oil tankers, and one offshore industry vessel. All MAIB incidents within the Shipping and Navigation study area were reported between 2013 and 2017, with four occurring in 2014 alone.

Additional MAIB data covering the previous 10-year period (2002-2011) will be considered in the NRA to identify any trends.

15.5 Embedded Mitigation

As part of the initial design process, embedded mitigation measures are proposed to reduce the potential environmental effects of development. Measures related to Shipping and Navigation are as follows:

- C-1: Development of and adherence to CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
- C-2: Development of and adherence to a DSLP. The DSLP will confirm the layout and design parameters of the Project.
- C-3: Development of and adherence to a FMMS. The FMMS will set out the means of ongoing fisheries liaison through construction and operation and maintenance phases of the Project and detail any mitigation measures to be put in place to limit effects on commercial fisheries activity.
- C-9: Development of and adherence to a MPCP. The MPCP will identify potential sources of pollution and associated spill response and reporting procedures.
- C-10: Development of and adherence to a NSP. The NSP will describe measures put in place by the Project related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Project activity to other sea users (e.g. via Notice to Mariners).
- C-13: Development of and adherence to a VMP. The VMP will confirm the types and numbers of vessels that will be engaged on the Project and consider vessel coordination including indicative transit route planning.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.
- C-16: Development of LMP in agreement with NLB and as per the requirements of International Association of Lighthouse Authorities (IALA) Recommendation O-139 (IALA, 2021a) and Guidance G1162 (IALA, 2021b)

- C-22: Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.
- C-24: Application for and use of Safety Zones of up to 500m during construction, maintenance and decommissioning phases. Where appropriate, guard vessels will also be used to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.
- C-26: Compliance of all Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1974) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974).
- C-27: Marine coordination and communication to manage project vessel movements
- C-33: Compliance with MCA MGN 654 (MCA, 2021) and its annexes where applicable. Also MGN 543 SAR annex 5 (MCA, 2018).
- C-34: Appropriate marking of the Project on Admiralty and aeronautical charts. This will involve provision of the positions and heights of structures to the UKHO, CAA, MoD and DGC.
- C-35: The construction area will be buoyed, as described in the NSP. Buoyage will be defined in consultation with the NLB.
- C-39: The layout of the Project, as presented in the DSLP, will be finalised in discussion with the MCA and the NLB in order to ensure the specific turbine layout is compatible with potential Search and Rescue activity.
- C-40: Failures to Project lighting and marking will be appropriately reported and rectified as soon as practicable. Interim hazard warnings will be put in place as required.
- C-43: Minimum blade clearance of at least 22m above MHWS.
- C-41: Guard Vessel(s) as required by risk assessment at the time of planning the activity.

15.6 Scoping of Impacts

15.6.1 Potential Impacts scoped in

A range of potential impacts on Shipping and Navigation have been identified, which may occur during the construction, O&M, and decommissioning phases of the Offshore Proposed Development as described in Section 15.5.

The impacts that have been scoped into the assessment at this stage are outlined in Table 15.2 (below).

Table 15.2: Impacts scoped into the assessment of Shipping and Navigation

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction and Decommissioning			
Vessel displacement	Third-party vessels may be displaced from their existing routes due to construction/decommissioning and O&M activities associated with the Offshore Proposed Development resulting in increased journey times and distances.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-3 (FMMS); C-9 (MPCP); C-14 (DP); C-16 (LMP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-33 (MGN 654); C-34 (UKHO Charts); C-39 (Layout Approval)
Increased vessel to vessel collision risk (third party to third party)	Vessels may be displaced or required to alter routes due to the presence of the Offshore Proposed Development or buoyed construction/ decommissioning area and may result in an increased number of third-party vessel encounters and consequently an increased third-party vessel collision risk.	Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop	C-3 (FMMS); C-9 (MPCP); C-10 (NSP); C-13 (VMP); C-14 (DP); C-16 (LMP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-34 (UKHO Charts); C-35 (Construction Buoyage)
Increased vessel to vessel collision risk (third party to project vessel)	The increased levels of vessel traffic in the area associated with the construction, operation and maintenance, and decommissioning of the Offshore Proposed Development may lead to increased collision risk between a third party and project vessel.	Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop	C-3 (FMMS); C-9 (MPCP); C-10 (NSP); C-13 (VMP); C-14 (DP); C-16 (LMP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-26 (COLREGs/SOLAS); C-27 (Project Vessel Coordination);

Impact	Description	Proposed Assessment Approach	Embedded mitigation
			C-34 (UKHO Charts); C-35 (Construction Buoyage)
Reduced access to local ports	Access to local ports, in particular Lerwick, may be impacted due to construction/decommissioning and maintenance activities associated with the Offshore Proposed Development. The extent of the impact will depend on the final landfall location chosen for the OfECC.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-1 (CaP); C-3 (FMMS); C-9 (MPCP); C-13 (VMP); C-14 (DP); C-22 (Promulgation of Information); C-26 (COLREGs/SOLAS); C-27 (Project Vessel Coordination); C-35 (Construction Buoyage).
Operation and Maintenance			
Creation of vessel to structure allision risk	The presence of surface structures will create new allision risk for powered vessels, drifting vessels and any vessels navigating between and internally within the Array Areas.	Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop	C-2 (DSLP); C-3 (FMMS); C-9 (MPCP); C-13 (VMP); C-16 (LMP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-26 (COLREGs/SOLAS); C-33 (MGN 654); C-34 (UKHO Charts); C-39 (Layout Approval); C-40 (Project Lighting and Marking Management); C-43 (Minimum Blade Clearance).

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Loss of station	Should a mooring system failure occur, a floating structure may lose station and become a floating hazard to passing vessels.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-3 (FMMS); C-9 (MPCP); C-10 (NSP); C-16 (LMP); C-22 (Promulgation of Information); C-33 (MGN 654); C-43 (Minimum Blade Clearance)
Reduction in under-keel clearance	The presence of subsea infrastructure including mooring lines, buoyant inter-array cables, or cable protection may increase under-keel interaction risk.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-1 (CaP); C-3 (FMMS); C-9 (MPCP); C-22 (Promulgation of Information); C-33 (MGN 654); C-34 (UKHO Charts).
Anchor or gear interaction with mooring lines or subsea cables	The presence of mooring lines and subsea cables may lead to an increase in the risk of anchor or fishing gear interaction. This impact will be considered in the NRA in relation to navigational safety only, i.e., effects on active fishing activity will be considered as part of the commercial fisheries assessment.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-1 (CaP); C-10 (NSP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-33 (MGN 654); C-34 (UKHO Charts).
Interference with navigation, communications, and position-fixing equipment	The Offshore Proposed Development infrastructure (e.g., WTGs, subsea cables) may impact equipment onboard vessels, including potential effects of electromagnetic interference from cables.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-1 (CaP); C-16 (LMP); C-22 (Promulgation of Information); C-33 (MGN 654); C-34 (UKHO Charts).

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Reduction of emergency response capability including SAR	The Offshore Proposed Development infrastructure and associated activities may reduce emergency response capability due to an increased number of incidents and/or access constraints, including in relation to SAR.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-2 (DSLP); C-9 (MPCP); C-13 (VMP); C-16 (LMP); C-24 (Safety Zones); C-26 (COLREGs/SOLAS); C-27 (Project Vessel Coordination); C-33 (MGN 654)
Vessel displacement	Third-party vessels may be displaced from their existing routes due to construction/decommissioning and O&M activities associated with the Offshore Proposed Development resulting in increased journey times and distances.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-3 (FMMS); C-9 (MPCP); C-16 (LMP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-33 (MGN 654); C-34 (UKHO Charts); C-39 (Layout Approval)
Increased vessel to vessel collision risk (third party to third party)	Vessels may be displaced or required to alter routes due to the presence of the Offshore Proposed Development or buoyed construction/ decommissioning area and may result in an increased number of third-party vessel encounters and consequently an increased third-party vessel collision risk.	Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop	C-3 (FMMS); C-10 (NSP); C-13 (VMP); C-16 (LMP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-33 (MGN 654); C-34 (UKHO Charts); C-41 (Guard Vessel(s).
Increased vessel to vessel collision risk (third party to project vessel)	The increased levels of vessel traffic in the area associated with the construction, operation and maintenance, and decommissioning of the Offshore Proposed Development may lead to	Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop	C-3 (FMMS); C-9 (MPCP); C-10 (NSP); C-13 (VMP); C-16 (LMP); C-22 (Promulgation of Information); C-24 (Safety Zones); C-26

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	increased collision risk between a third party and project vessel.		(COLREGs/SOLAS); C-27 (Project Vessel Coordination); C-34 (UKHO Charts); C-41 (Guard Vessel(s)).
Reduced access to local ports	Access to local ports, in particular Lerwick, may be impacted due to construction/decommissioning and maintenance activities associated with the Offshore Proposed Development. The extent of the impact will depend on the final landfall location chosen for the OfECC.	Desk Study, Stakeholder Consultation, and Hazard Review Workshop	C-1 (CaP); C-3 (FMMS); C-9 (MPCP); C-13 (VMP); C-22 (Promulgation of Information); C-26 (COLREGs/SOLAS); C-27 (Project Vessel Coordination).

15.6.2 Potential Impacts scoped out

No impacts are currently scoped out at this stage in line with MGN 654 (MCA, 2021) requirements.

15.7 Potential Cumulative Impacts

All impacts identified on an in-isolation basis will be considered within the NRA for the potential for cumulative effects. Cumulative developments will be assessed based on the most recent publicly available information at the time with a screening exercise undertaken to determine which cumulative developments should be considered and to what degree (through use of a tiering system). Factors which will be considered in the screening exercise include:

- Distance from the Offshore Proposed Development;
- Development status;
- Level of interaction with main commercial routes passing in proximity to the Offshore Proposed Development;
- Consultation feedback; and
- Data confidence level.

This method will take international vessel operators and ports into consideration. To sufficiently capture effects, both base-case and future-case scenarios will be applied in terms of deviations for main commercial routes on a cumulative level.

15.8 Potential Transboundary Impacts

Given the international nature of shipping, the in-isolation impact assessment and the CIA will consider vessel routeing to and from international ports by international operators. Therefore, impacts listed in Section 15.5 may be relevant at a transboundary level.

15.9 Proposed Approach to EIA

15.9.1 Relevant Guidance

In addition to the general approach and guidance outlined in Chapter 4: EIA Methodology, the assessment of shipping and navigation receptors will also comply with the following guidance documents where they are specific to this topic:

- MGN 654 (Merchant and Fishing) Safety of Navigation: OREIs – Guidance on UK Navigational Practice, Safety and Emergency Response and its annexes (MCA, 2021);
- MGN 372 Amendment 1 (Merchant and Fishing) OREIs: Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA, 2022);
- Revised Guidelines for Formal Safety Assessment (FSA) for Use in the IMO Rule-Making Process (IMO, 2018);
- IALA Guideline G1162 Guidance on the Marking of Offshore Man-Made Structures (IALA, 2021 (a));
- IALA Recommendations O-139 on The Marking of Man-Made Offshore Structures (IALA, 2021 (b));
- The RYA's Position on Offshore Renewable Energy Developments: Paper 1 (of 4) - Wind Energy (RYA, 2019);
- COLREGs (IMO, 1972/77);
- SOLAS (IMO, 1974); and

- United Nations Convention on the Law of the Sea (UNCLOS) (United Nations (UN), 1982).

15.9.2 Anticipated Additional Data Sources at EIA

A more detailed literature review will be developed for the EIA / NRA, building upon the high-level outline provided within this Offshore Scoping Report. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions.

This will likely include two seasonally varied vessel traffic surveys for the Shipping and Navigation study area in compliance with the requirements of MGN 654 (MCA, 2021). In particular, this will consist of a minimum of two 14-day periods of AIS, Radar and visual observations data. However, exact requirements will be agreed with the MCA.

Together, these datasets, in addition to those detailed in Section 15.3, will ensure that non-AIS vessels are suitably characterised when establishing the baseline environment in the EIA and allow seasonal variations to be identified.

Additionally, AIS data from desktop sources covering two seasonal 14-day periods will be used to characterise vessel movements within and in proximity to the OfECC. As noted in Section 15.2, the study area for this dataset is likely to be a 2 nm buffer of the OfECC.

Consultation with relevant stakeholders will also be used to further inform the baseline environment and impact assessment. Detailed consultation will be undertaken during the EIA / NRA process with key stakeholders relevant to shipping and navigation, including:

- MCA;
- NLB;
- RYA Scotland;
- UK Chamber of Shipping;
- RNLI;
- Cruising Association;
- Local ports and harbours, e.g., Lerwick Harbour;
- SFF;
- Regular vessel operators identified from the vessel traffic data; and
- Local marinas and yacht clubs.

15.9.3 Assessment Methodology

As required under the MCA methodology (Annex 1 to MGN 654) (MCA, 2021) and in line with international marine risk assessment standards, the IMO FSA (IMO, 2018) approach will be applied to the assessment of effects.

The FSA methodology is centred on risk control. The method assesses each hazard (impact) in terms of its frequency of occurrence and the severity of its consequence, to determine its significance as either ‘broadly acceptable’, ‘tolerable’ or ‘unacceptable.’ The FSA methodology risk matrix is shown in Table 15.3. Any impact assessed as ‘unacceptable’ will require additional mitigation measures implemented beyond those considered designed-in to reduce the impact to within ‘tolerable with mitigation’ or ‘broadly acceptable’ parameters.

Table 15.3: IMO FSA Risks

		Severity of Consequence				
		Negligible	Minor	Moderate	Serious	Major
Frequency of Occurrence	Frequent	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable	Unacceptable	Unacceptable
	Reasonably Probably	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable	Unacceptable
	Remote	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable
	Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation

The frequency and consequence rankings per hazard will be determined using a number of inputs, notably:

- Quantitative modelling undertaken in the NRA (Anatec's COLLRISK software);
- Outputs of the characterisation of the baseline including vessel traffic surveys;
- Consideration of proposed mitigation measures;
- Lessons learned from other offshore wind farm developments;
- Level of stakeholder concern determined though the hazard log;
- Consultation output; and
- Expert opinion.

15.10 Scoping Questions

The following scoping questions refer to the shipping and navigation chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area (s) defined for Shipping and Navigation?
- Do you agree with the use of those data listed in Section 15.3, and any additional anticipated data listed in Section 15.9, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to Shipping and Navigation have been identified?
- Do you agree with the proposed study areas identified for the Shipping and Navigation receptors?
- Do you agree with the impacts scoped for Shipping and Navigation and in particular those relating to the use of floating technology?

- Do you agree the embedded mitigation is appropriate, or are there other measures that should be included?
- Do you agree with the proposed assessment methodology related to Shipping and Navigation?
- Are there any additional shipping and navigation organisations that you would recommend be consulted?

16 Marine Archaeology and Cultural Heritage

16.1 Introduction

This chapter of the Offshore Scoping Report identifies the known and potential marine archaeology and cultural heritage receptors of relevance to the Offshore Proposed Development. The chapter considers the potential impacts from the construction, O&M, and decommissioning stages of the Offshore Proposed Development on marine archaeology and cultural heritage receptors up to MHWS and proposes the methodology and approach to assessing these impacts. Cultural heritage and archaeology receptors in the intertidal zone, between MLWS and MHWS, will also be considered within the Terrestrial Archaeology and Cultural Heritage chapter of the Onshore Scoping Report.

This chapter should be read alongside the following other Chapters:

- Chapter 6: Marine Geology, Oceanography and Physical Process; and
- Chapter 12: Seascape, Landscape and Visual Impact Assessment.

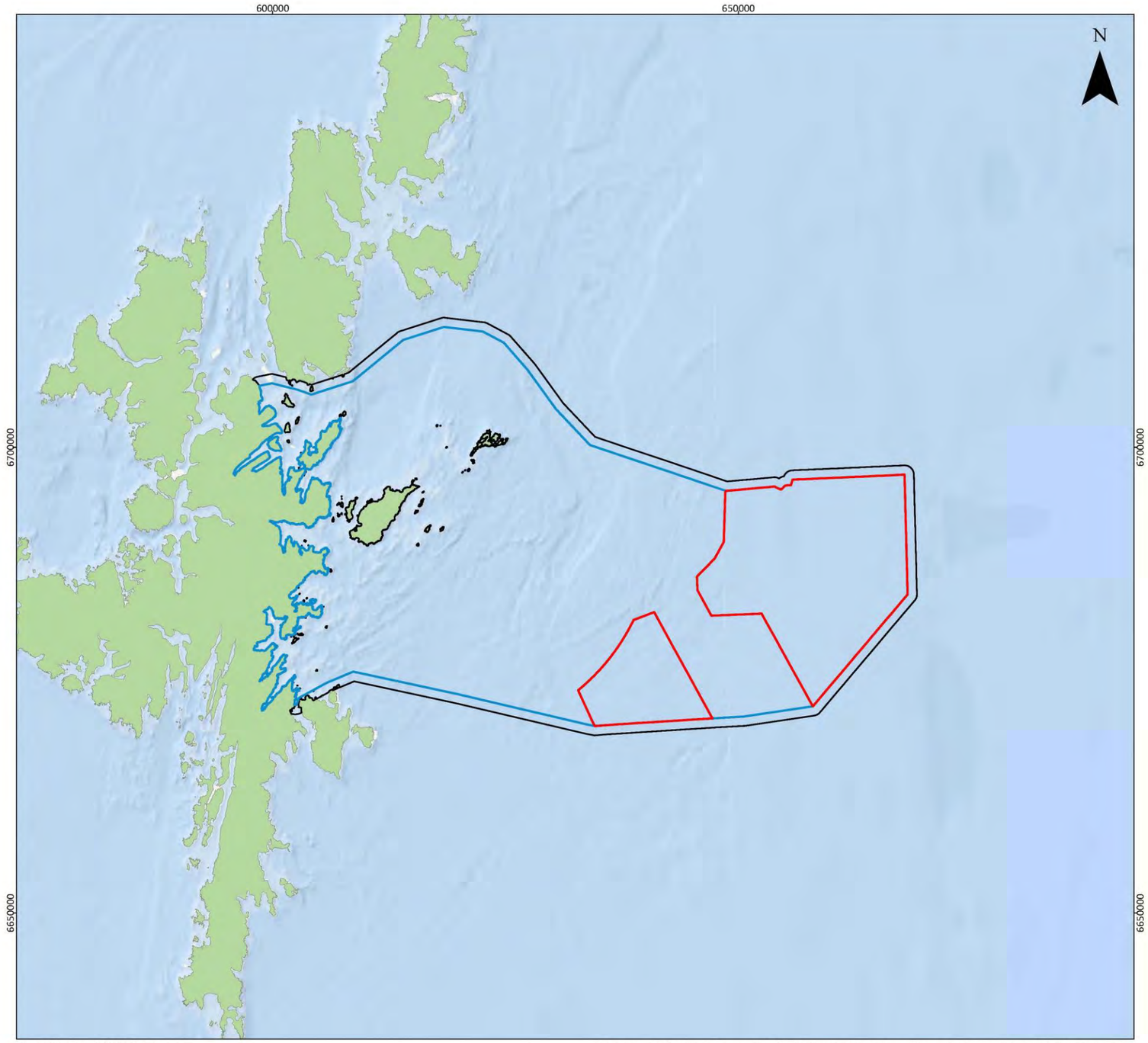
Chapter 6: Marine Geology, Oceanography and Physical Processes assesses sediment transport and scouring that may cause bathymetric changes and proposes the methodology and approach to assessing these impacts; the results of which are important for understanding the potential indirect impact that the development infrastructure may have on marine archaeology and cultural heritage receptors at the seabed.

Chapter 12: Seascape, Landscape and Visual Impact Assessment assesses the visual impact of the Offshore Proposed Development and proposes the methodology and approach to assessing these impacts; the results of which are important for understanding the potential indirect impact that the development infrastructure may have on the setting of marine archaeology and cultural heritage assets.

This chapter of the Offshore Scoping Report has been prepared by Wessex Archaeology Ltd.

16.2 Study Area

The marine archaeology and cultural heritage study area is defined by the Offshore Proposed Development footprint, comprising the Offshore Array Areas and the Offshore Export Cable Corridor (ECC), offshore from MHWS. A 1 km buffer has been added that will be used to capture relevant data on known designated and non-designated marine archaeological assets, and to provide wider context for understanding archaeological potential and heritage significance of receptors that may be affected by the Offshore Proposed Development (Figure 16.1). It is noted that a refined OfECC will be identified within the existing area of search ahead of EIA.



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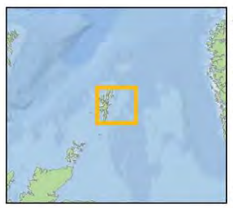
Scoping Report

Marine Archaeology and Cultural Heritage Study Area

Legend

- Study Area
- Array Areas
- Offshore Export Cable Corridor Area of Search



Notes

World Ocean Base: OceanWise, Esri, Garmin, NaturalVue
World Ocean Base: Esri, GEBCO, Garmin, NaturalVueContains Ordnance Survey data © Crown copyright and database rights (2024). OS OpenData.

Coordinate System:
WGS 1984 UTM Zone 30N

0 10 20 km
0 5 10 nm

Scale	Date	Drawn by	Checked by	Approved by
1:400,000 @A3	04/03/2024	KJF	SM	AB

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Figure 16.1

Figure Reference: 277680_ArcPro

Figure 16.1: Marine Archaeology and Cultural Hertiage Study Area

16.3 Data Sources at Scoping

The data sources that have been used to inform this chapter are presented within Table 16.1. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data that will be collected for the Offshore Proposed Development.

For this Offshore Scoping Report, the primary resource are wreck sites with positions verified by the UKHO, as well as the maritime dataset from Canmore. The marine coverage of the Shetland Historic Environment Record (HER) has been acquired and reviewed but not used for the purposes of illustration in scoping at this time.

The potential for submerged archaeological assets such as palaeolandscapes and prehistoric remains was assessed using relevant available literature and baseline datasets.

Table 16.1: Data sources used to inform Marine Archaeology and Cultural Heritage scoping chapter

Title	Summary	Source	Author and year
UKHO Wreck Database	A record containing charted and uncharted wrecks, and obstructions.	UKHO	October 2023
Canmore database	The National Record of the Historic Environment of Scotland. Compiled and managed by HES. Contains entries for archaeological sites, findspots and archaeological events, including buildings, industry, and maritime heritage.	HES	October 2023
Shetland Historic Environment Record database	Records of marine and maritime sites of archaeological and historical interest.	Shetland Amenity Trust	November 2023
BGS GeoIndex Offshore	Marine Environmental Data and Information Network (MEDIN) data archive centre for sources on marine geology and existing datasets.	BGS	October 2023

16.4 Baseline Environment

16.4.1 Overview of Baseline Environment

16.4.1.1 Marine Historic Assets

Marine historic assets are defined in the Marine (Scotland) Act 2010, Section 73 (5) as vessels, vehicles, aircrafts, remains of such, parts of such, contents of such, buildings and other structures (or parts of such), caves, deposits, artefacts or any other thing or groups of things that evidence previous human activity.

Marine archaeological and cultural heritage receptors located within the study area can be characterised as comprising four fundamental categories:

- Seabed prehistory;
- Maritime archaeology;
- Aviation archaeology; and
- Intertidal archaeology

16.4.1.2 Seabed Prehistory

Seabed prehistory refers to the known and potential submerged palaeolandscapes and archaeology caused by changes in global sea levels since the last ice age (NSPRMF 2022, Bicket and Tizzard 2015). Which in a Scotland context reflects archaeological potential for Later Upper Palaeolithic, Mesolithic and early Neolithic, generally; with local variations in distal northerly and westerly island groups, such as Shetland.

Within the region there is potential for relict submerged geomorphology and topography (e.g. palaeochannels, submerged forests and estuaries) faunal remains, and artefactual evidence for the humans and animals which existed within those inundated landscapes. Relative sea level data is typically poorly constrained for the British Isles in deeper water depths, but existing models suggest potential for submerged palaeolandscapes coeval with early prehistoric periods in at least - 30m OD, but this is not currently well-constrained around Shetland in deeper water (e.g. Shennan *et al*., 2018; Dawson *et al* 2020).

Shetland also preserves evidence of high-magnitude events such as the second Storegga tsunami, an important element for understanding coastal change during early prehistory, around 8,000 years ago (e.g. Dawson *et al* 2020).

16.4.1.3 Maritime Archaeology

Maritime archaeological sites can be considered to comprise two broad categories; the remains of vessels that have been lost as a result of stranding, foundering, collision, enemy action and other causes (e.g. shipwrecks), and those sites that consist of vessel-related material including jetsam, flotsam, lagan and derelict.

Vessel-related material includes (but is not limited to) equipment lost overboard or deliberately jettisoned, such as fishing gear, ammunition and anchors, or the only surviving remains of a vessel such as its cargo or a ballast mound.

Shipwrecks on the seabed provide an insight into the types of vessels used in the past, the nature of shipping activity in the wider area and the changing usage of the marine environment through different periods. Such remains are considered more likely in sediments which promote the preservation of wreck sites (e.g. finer

grained sediments that are not subject to high levels of mobility), particularly where such sediments have seen limited, recent disturbance.

16.4.1.4 Aviation Archaeology

Marine aviation archaeology receptors comprise the remains or associated remains of military and civilian aircraft that have been lost at sea (Wessex Archaeology, 2008). Evidence is divided into three primary time periods based on major technological advances in aircraft design: Pre-1939; 1939-1945; and post-1945. There are reported sites of aircraft crash sites in the study area and there is particularly high potential for the discovery of aircraft from 1939-1945.

16.4.1.5 Intertidal Archaeology

Intertidal archaeology is any of the above receptors which may be found within the intertidal zone between MHWS and MLWS along the coastline. This can also include maritime structures such as piers, harbours and slipways.

16.4.2 Offshore Array Areas

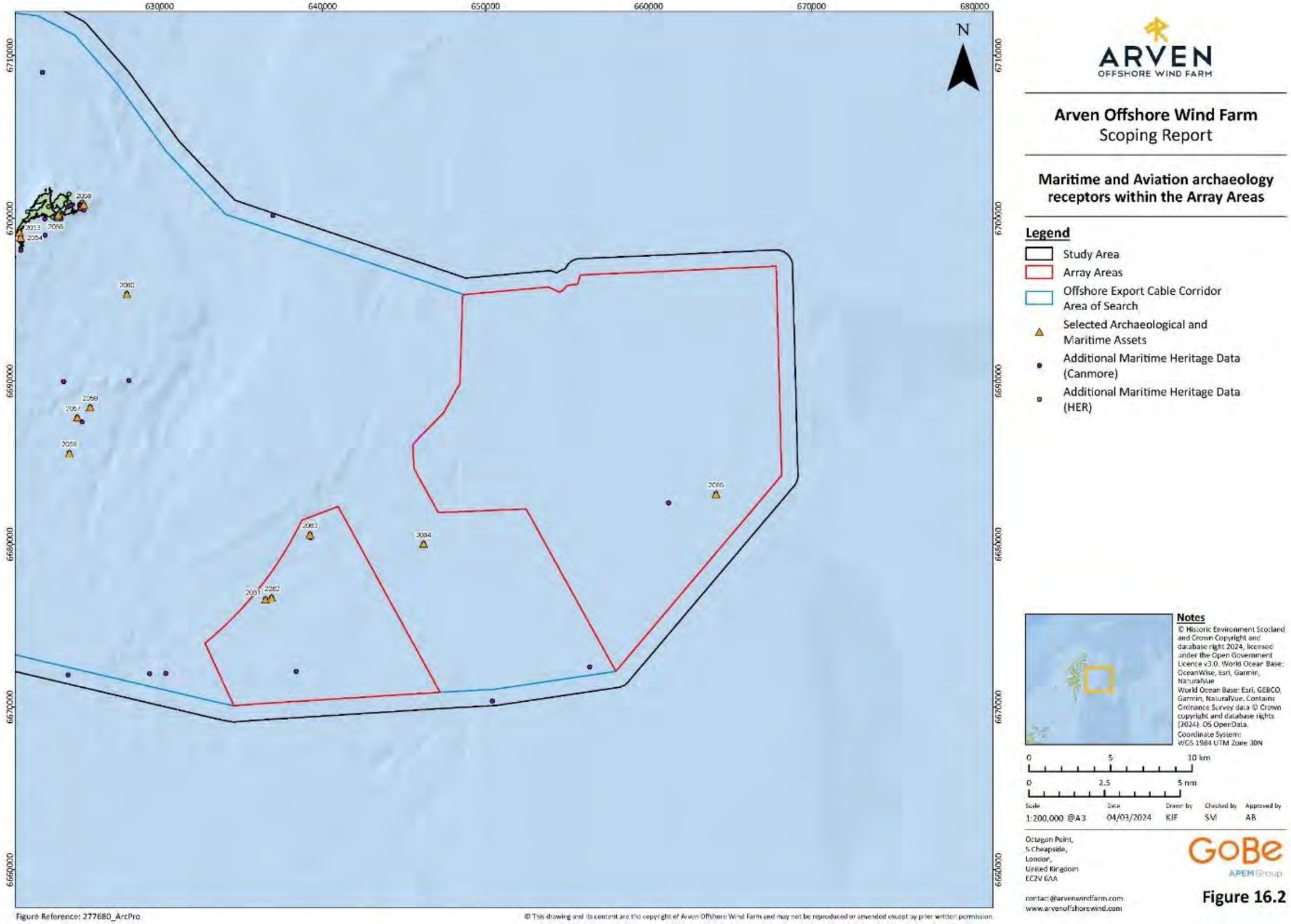
16.4.2.1 Seabed Prehistory

There are currently no known submerged prehistoric assets within the study area around the Offshore Array Areas. Relative sea-level in Shetland during the last 15,000 years was significantly lower than present day, c. -30+ m lower during the early Holocene (e.g. Shennan *et al.*, 2018). In these broad terms, the potential for encountering submerged prehistory and palaeolandscape features encompasses the seabed in shallower waters, and potential may be limited or absent in the Array Areas.

16.4.2.2 Maritime Archaeology

There are seven records listed by the UKHO and Canmore located in the Array Areas (Table 16.2; Figure 16.2). These comprise of:

- Four charted wreck sites; and
- Three Recorded Losses (these are not mapped as their position is tentative and not accurate).



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Maritime and Aviation archaeology receptors within the Array Areas

Legend

- Study Area
- Array Areas
- Offshore Export Cable Corridor Area of Search
- Selected Archaeological and Maritime Assets
- Additional Maritime Heritage Data (Canmore)
- Additional Maritime Heritage Data (HER)

Notes

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World Ocean Base: Esri, GEBCO, Garmin, NaturalVue. Contains Ordnance Survey data © Crown copyright and database rights (2024). OS OpenData.
Coordinate System: WGS 1984 UTM Zone 30N

0 5 10 km
0 2.5 5 nm

Scale	Date	Drawn by	Checked by	Approved by
1:200,000 @A3	04/03/2024	KJF	SVI	AB

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Figure 16.2

Figure 16.2: Maritime and Aviation archaeology receptors within the Array Areas

Where the record is present on both the UKHO and Canmore databases the position of the UKHO record has been taken as most likely to be correct, and any additional information from the Canmore record added to a single gazetteer entry.

Table 16.2: Maritime archaeology assets within the Array Areas

Site ID	Site name	Further info	UTM30N Easting	UTM30N Northing
2061	*Laatefos* (Possibly): North Sea	Craft	636495	6676634
2062	*Leo Dawson*	Steam Ship, 110.7m in Length, 15.5m Beam, 8m Draught, Tonnage 4330t.	636873	6676735
2063	Unknown craft	Craft	639227	6680611
2065	*Loraley*	Fishing vessel, 22.9 in Length, Tonnage 49t.	453000	1161000
Canmore 325789	Unknown craft			
Canmore 242931	*Laatefos*			
Canmore 242928	*Vesterland*			
-	*Opportune*	Fishing vessel	512514	1155925

One of the wreck records (**WA 2065; UKHO 142**) is for the *Loreley,* a fishing vessel which sank in 1990, and *Opportune* which only sank in March 2024 (thus currently has no Site ID). Due to the recent nature of these sinkings the records have no archaeological potential; however, they will be retained within the gazetteer as debris or other anthropogenic material may remain on the seabed.

The other three records relate to two steamships sunk by submarines during the First and Second World Wars, and a wreck of an unknown craft which has minimal information about it (**WA 2063; UKHO 108**). The wreck of the *Leo Dawson* (**WA 2062; UKHO 135**), an iron or steel steamship measuring 110.7 m in length and 15.5 m beam with a tonnage of 4,330t, is located within the western area of the Array Areas. This ship was sunk in

February 1940 by one torpedo from *U-37* with the whole crew of 35 being lost with the ship. The record for the possible wreck of the *Laatefos* (**WA 2061; Canmore 290832**), is also located within the western area of the Array Areas, however further research into this vessel suggested it may have been torpedoed and sunk west of Shetland in 1917. Its location is very close to the recorded location for the *Leo Dawson* and so it may be a data error that may be resolved with further baseline assessment and research.

In addition to these wrecks the Canmore database includes three Recorded Losses located within the Array Areas. These include an unknown vessel listed as sinking in 1702 and two 20th century steamship losses: one of which is another record for the *Laatefos* and the other is for the *Vesterland*, which was also sunk by *U-17* in May 1917 with a cargo of oilcake. Recorded Losses refer to ships and aircraft that are recorded as having been lost, but for which the exact locations are not known. The records for these losses provide additional documentary evidence for the potential discovery of sites and material relating to maritime and aviation activity within the study area. All the ships date to post-medieval or modern periods when more accurate records were being maintained and archived. However, there is also potential for earlier vessels whose loss was simply not recorded. Shipwreck inventories and documentary sources are usually biased towards the 18th century and later when more systematic reporting began. Therefore, there are few known historical records of wrecks from medieval or earlier periods.

16.4.2.3 Aviation Archaeology

There are no known aviation sites recorded within the Array Areas or associated study area. Potential for aviation archaeology across the study area will be discussed in the OfECC section below.

16.4.3 Offshore Export Cable Corridor

16.4.3.1 Seabed Prehistory

There are currently no known submerged prehistoric assets within the study area around the OfECC, in large part due to significant data gaps and distribution of existing research projects into the palaeolandscape potential of shallower coastal waters in the northern North Sea (Bicket and Tizzard, 2015; Dawson *et al*., 2017).

Hominids and humans have occupied the British Isles at various times, with the earliest occupation extending back to around one million years (Parfitt *et al*., 2010), with coastal areas clearly attracting human populations, including landscapes that are now submerged (Bailey *et al*., 2020).

The earliest archaeological evidence for Scotland comprises around the last 15,000 years and reflects Later Upper Palaeolithic and Early Mesolithic human activity at various locations across Scotland (Saville et. al., 2012) in periods when (now-inundated) coastal land was more extensive than today, due to lower global sea-levels following the end of the last ice age (Gaffney and Fitch, 2022).

In shallower water there is increased potential for encountering submerged palaeolandscapes of prehistoric archaeological potential. The specific potential for in situ archaeological remains of this nature will be increased where Late Pleistocene and early Holocene terrestrial and coastal sediments are preserved in the OfECC.

16.4.3.2 Maritime Archaeology

To illustrate the high numbers of records located in the OfECC study area, 62 records listed by the UKHO, Canmore and HER are summarised in the gazetteer (Table 16.3; Figure 16.3). These comprise:

- 40 wreck sites, including two designated and protected wrecks (see Section 16.4.5);
- seven wreck sites that are now listed as dead (i.e. they have not been located by repeated surveys, however there may still be wreck material at these locations);
- two wrecks that have been lifted (i.e. almost wholly salvaged, although there may still be wreck material and debris around the locations);
- thirteen obstructions or foul ground.

Where the record is present on both the UKHO, Canmore and HER databases the position of the UKHO record, especially if recent precise surveys have occurred, has been used for the purposes of this Offshore Scoping Chapter, and relevant supplemental information from the Canmore and HER records added to the gazetteer entry.

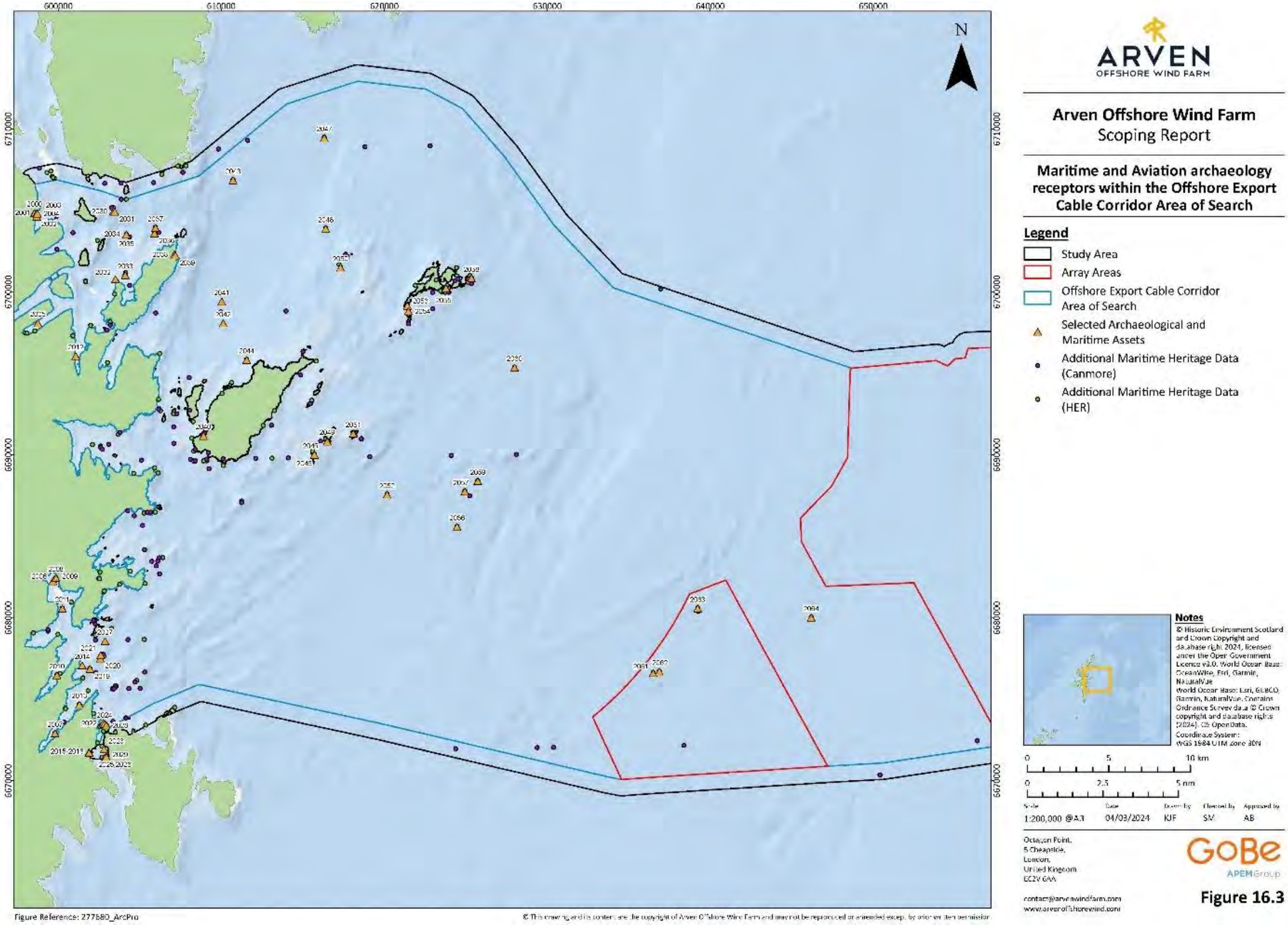


Figure 16.3: Maritime and Aviation archaeology receptors within the Offshore Export Cable Corridor Area of Search

Table 16.3: Maritime and Aviation archaeology receptors within the Offshore Export Cable Corridor

Site ID	Site Name	Further Info	UTM30N Easting	UTM30N Northing
2000	Unknown: Booth Of Toft, Tofts Voe, Yell Sound	Craft	598538	6704865
2001		Obstruction	598542	6704849
2002		Obstruction	598670	6704636
2003		Obstruction	598680	6704853
2004		Obstruction	598711	6704823
2005			598749	6698099
2006	*Fitful Head*	Steam Drifter	599666	6682287
2007		Obstruction	599796	6672944
2008	*Fitful Head*: Cat Firth	Steam Drifter	599843	6682478
2009		Craft	599844	6682477
2010		Craft	599915	6676507
2011	Unknown: Cat Firth	Craft	600247	6680606
2012	*Aquaris*	Trawler, 13.7m In Length, 4.9m Beam, 2.1m Fraught, Tonnage 20t. Lifted.	601064	6696082
2013		Obstruction, Pipes/Tubes/Diffusers, 30m In Length.	601289	6674697
2014	H.102	Barge, 126.5m In Length, 25.9m Beam, 6.7m Draught, Tonnage 5652t. Lifted.	601469	6677106

Site ID	Site Name	Further Info	UTM30N Easting	UTM30N Northing
2015	Unknown: Bressay Sound	Craft	601881	6671779
2016	Unknown: Bressay Sound	Craft	601881	6671749
2017		Obstruction	601887	6671779
2018		Obstruction	601888	6671748
2019	*Sea Mist*	Fishing Vessel- Lobster Boat, 7.3 M In Length. Sunk On 10/08/1991	601936	6676902
2020	HMS *Rondo*	Steam Ship, 26.9m In Length, 6.1m Beam, 3.2m Draught, Tonnage 117t. Listed As Dead.	602581	6677533
2021	*Borodinskoye Polye*	Fishing Vessel, 101.8m In Length, 15.2m Beam, 5.8m Draught, Tonnage 3147t.	60259	66777523
2022	*Prospect*	Fishing Vessel, 18m In Length. Listed As Dead.	602757	6673586
2023	Unknown: Bressay Sound	Motor Torpedo Boat (20th Century)	602808	6671973
2024	*River Lossie*	Trawler- Steel Hull, Tonnage 201t.	602832	6673523
2025	Unknown: Bressay Sound	Barge (20th Century)	602836	6671443
2026	Unknown: Bressay Sound, Dry	Obstruction(S) (20th Century)	602846	6671443

Site ID	Site Name	Further Info	UTM30N Easting	UTM30N Northing
	Dock And Mooring Blocks			
2027			602865	6678602
2028	*Treasure*	Fishing Vessel, Tonnage 29t. Lifted. Registered As Lk 92	602943	6673434
2029	Girdleness	Intact Open Hull Barge, Length 18m.	602945	6671500
2030			603396	6704978
2031			603461	6704937
2032			603504	6700802
2033		Obstruction	604107	6701043
2034		Obstruction: Anchor Or Other Obstruction	604173	6703524
2035	*Ocean Way*	Fishing Vessel, Listed As Dead Wreck, Tonnage 268t. Listed As Dead.	604174	6703522
2036	*Reliance*	Fishing Vessel- Wooden Hull, 12.2m In Length. Listed As Dead.	605899	6703602
2037	Unknown: Lunna Ness	Obstruction: Anchor	605965	6703945
2038	*Margaret Stephen*: Wick Of Glachon, Lunna Ness, North Sea	Steam Trawler (20th Century)	607119	6702314
2039			607179	6702263

Site ID	Site Name	Further Info	UTM30N Easting	UTM30N Northing
2040	*Verdant*	Fishing Vessel. Registered As Lk288	608900	6691187
2041	HMS *White Daisy*	Fishing Vessel Sunk On 25/09/1940, Tonnage 79t. Listed As Dead. Canmore Listing Gives Registration As Lk304, Requisitioned Steam Drifter	610031	6699423
2042			610113	6698087
2043	*Kiaull Marrey*	Fishing Vessel, 17.4m In Length, Tonnage 38t.	610720	6706874
2044		Obstruction: Fishing Farm/Gear/Haven/Tanks/Traps. Listed As Dead.	611557	6695844
2045	*Jupiter:* Flaeshans Of Rumble, Whalsay Skerries, North Sea	Steam Trawler (20th Century)	615707	6690042
2046	Unknown: Flaeshans Of Rumble, Whalsay Skerries, North Sea	Craft	615707	6690042
2047		Obstruction: 5100m Of 50mm Wire	616320	6709463
2048	*Freeway*	Beam Trawler, Steel Hull, 14m In Length, 4.9m Beam, 2.1m Draught, Tonnage 26t.	616408	6703895

Site ID	Site Name	Further Info	UTM30N Easting	UTM30N Northing
2049	*Pacific*: Gun Geo, Snafa Baa, East Linga, Whalsay Skerries, North Sea	Steamship (19th Century)	616495	6690854
2050	*Fort La Prairie*	Steam Ship, Tonnage 7138t. Listed As Dead.	617311	6701509
2051	Evstafii: Grif Skerry, Whalsay Skerries, North Sea	Pink (18th Century)	618098	6691319
2052	*Destiny*	Fishing Vessel, 20.1m In Length.	620173	6687595
2053	*De Liefde*	Dutch East Indiaman. 17th Century Sailing Vessel. Listed As Dead.	621413	6699168
2054	Unknown: Benelip Sound, Out Skerries, North Sea	Craft (17th Century)	621475	6698832
2055	*Kennemerland*	18th Century Dutch East Indiaman. Listed As Historic.	623780	6700238
2056	G-BEID	Helicopter (Transport From Oil Rigs)	624464	6685619
2057	Unknown: North Sea	Craft(S) (Period Unknown)	624943	6687782

Site ID	Site Name	Further Info	UTM30N Easting	UTM30N Northing
2058	*Wrangels Palais*	Military Vessel, 38.1m In Length, 11.3m Beam. Listed As Historic. Danish Warship, 17th Century	625351	6700849
2059		Craft	625735	6688418
2060	*Valhallah*	Fishing Vessel- Wooden Hull, 19.2m In Length, 6.6m Beam, 2.5m Draught, Tonnage 47t.	627993	6695370
2064	*Anna* (Possibly)	Steam Ship, 73.2m In Length, 11m Beam, 4.6, Draught, Tonnage 1211t.	646194	6680048

Many of the known wreck sites date to the 20th century, in particular relating to the First and Second World Wars, however there are also numerous records for vessels that sank post-1945. The wrecks of two requisitioned steam drifters lie within the study area, one dated to the First World War and one to the Second World War. HMS *Rondo* (**WA 2020; UKHO 64331; HER 6695**) ran aground on Unicorn Rock and eventually broke apart. This is also the location of the 1993 loss of the Russian factory ship *Borodinskoye Polye* (**WA 2021; UKHO 93; HER 6696**) and divers have noted that the area is covered with wreckage from this ship which may obscure any earlier wreckage. HMS *White Daisy* (**WA 2041; UKHO 110**) was a requisitioned steam drifter which foundered east of Lerwick in 1940. In addition to this there is a record for the loss of a motor torpedo boat (**WA 2023; Canmore 282632**) which is thought to relate to either MTB 626 or 686, both of which were Fairmile D MTBs assigned to the Norwegian Navy. They are recorded as having exploded within Lerwick harbour in November 1943 and divers have identified the location of at least one of them on the seabed. The study area contains other cargo ships sunk during the 20th century conflicts including the *Anna* (**WA 2064; UKHO 106**), sunk in 1917 and the *Fort la Prairie* (**WA 2050; UKHO 112; HER 6743**) sunk in 1945.

Twelve of the UKHO records relate to fishing boats or other craft that sank after 1950, including ten fishing trawlers, a barge and the Russian fish factory ship *Borodinskoye Polye* mentioned above. Although these wreck sites do not have archaeological value, they still have social and cultural value, and equally they would be considered navigational hazards for the Offshore Proposed Development. Despite their lack of archaeological value, these records will be retained in the gazetteer of seabed assets.

Table 16.4: Modern records within the Study Area

Site ID	Site name	UTM30N Easting	UTM30N Northing	Vessel type
2012	*Aquaris*	601064	6696082	Trawler
2014	H.102	601469	6677106	Barge
2019	*Sea Mist*	601936	6676902	Fishing vessel
2021	*Borodinskoye Polye*	602599	6677753	Fish Factory Ship
2022	*Prospect*	602757	6673586	Fishing vessel
2024	*River Lossie*	602832	6673523	Trawler
2036	*Reliance*	605899	6703602	Fishing vessel
2040	*Verdant*	608900	6691187	Fishing vessel
2043	*Kiaull Marrey*	610720	6706874	Fishing vessel
2048	*Freeway*	616408	6703895	Trawler
2052	*Destiny*	620173	6687595	Fishing vessel
2060	*Valhallah*	627993	6695370	Fishing vessel

The presence of post-medieval vessels such as *de Liefde* (**WA 2053; UKHO 110**) and the two wrecks discussed in Section 16.4.5 demonstrate the high potential for the wrecks of large commercial vessels from the 16th centuries onwards to be within the study area. The waters east of Shetland were an important navigation route for ships sailing from and to Northern Europe who didn't or couldn't navigate through the English Channel. The waters are also notoriously dangerous, with errors in navigation having the distinct possibility of causing wrecking on the many islands and skerries around Shetland.

The Canmore database includes 263 other entries including wrecks and Recorded Losses located within the OfECC and wider study area. These include a number of vessels related to the 16th – 18th centuries, and unusually one Recorded Loss from the early medieval period (a 9th century wreck of a vessel carrying horses near Lerwick).

In addition to these wrecks, the HER data holds 115 other entries including wrecks and Recorded Losses located within the OfECC and wider study area. These include a number of vessels related to the 16th – 18th centuries and a number of modern wrecks.

The vast majority of the ship Recorded Losses date to the 18th century or later when more accurate records were being maintained and archived. However, there is also potential for earlier vessels whose loss was simply not recorded. There is high potential for both unknown, unrecorded vessels and reported but unlocated losses to have sunk in the Array Areas and the OfECC over many centuries. Particularly high potential is noted in the area where these Recorded Losses are clustered: along the eastern inshore seaboard of Mainland, Shetland and Bressay, on the approaches to Out Skerries, around Whalsay and the skerries around East Linga.

It should also be noted that any of the unidentified sites or obstructions could relate to either shipwreck or aircraft sites and that material could still exist on or under the seabed of the sites described as 'dead' or 'lifted'.

16.4.3.3 Aviation Archaeology

There is one aviation site recorded in the UKHO records, which is the wreck of a helicopter (**WA 2056/UKHO 140**). This aircraft was a Sikorsky S-61 helicopter transporting workers from the Forties oilfield to Sumburgh airport on 13th July 1988. It made a controlled ditching due to an engine fire and all aboard were rescued. The helicopter broke apart and sank after the fire caused further damage. The large sections of the helicopter were recovered after the accident, but there is potential for some elements to remain on the seabed. Similarly, to the modern fishing boat records discussed above, the remains have no archaeological importance, but the site will be retained in the gazetteer for completeness.

There are three records of aviation sites recorded in Canmore located in the study area (Table 16.5). However, these are recorded losses, as their positional location is approximate or arbitrary and no wreck material has been confirmed at the listed location.

Table 16.5: Aviation records within the Study Area

Site ID	Site name	UTM30N Easting	UTM30N Northing	Record type
WA 2056/ UKHO140	Helicopter G-BEID. Sikorsky S-61	624464.11	6685618.94	Aircraft Wreck
Canmore 238615/HER 6412	Consolidated Catalina: Point of Gruid, Whalsay, North Sea			Recorded Loss
Canmore 290867	Junkers Ju-88: North Sea			Recorded Loss
Canmore 290707	Consolidated Catalina IVa JX581: Point of			Recorded Loss

Site ID	Site name	UTM30N Easting	UTM30N Northing	Record type
	Gruid, Whalsay, North Sea			

There were a number of airfields in the vicinity of the Offshore Proposed Development during the Second World War, including RAF Scatsta, RAF Sumburgh and RAF Sullom Voe. From 1939 to 1945, a number of aviation bases were maintained in Shetland, as well as Orkney and Northeast Scotland, supporting various roles including maritime patrol and defence; and, for example, Luftwaffe missions based in Norway to Scotland also suggest potential for historic aviation activity in the region.

Maritime aircraft crash sites can retain a significant amount of material, whilst being an ephemeral target to identify in geophysical survey datasets, with the potential for in situ human remains.

The remains of crashed military aircraft are protected under the PMRA 1986 and cannot be disturbed without a licence.

16.4.4 Landfall

16.4.4.1 Intertidal Archaeology

There is potential for marine cultural heritage to exist within the intertidal area of the study area, located between the MHWS and MLWS marks. This includes both the known resource and currently unknown resource.

Once the extent of the landfall for the Offshore Proposed Development has been refined, a full assessment of the baseline of known and potential cultural heritage located within this area will be undertaken.

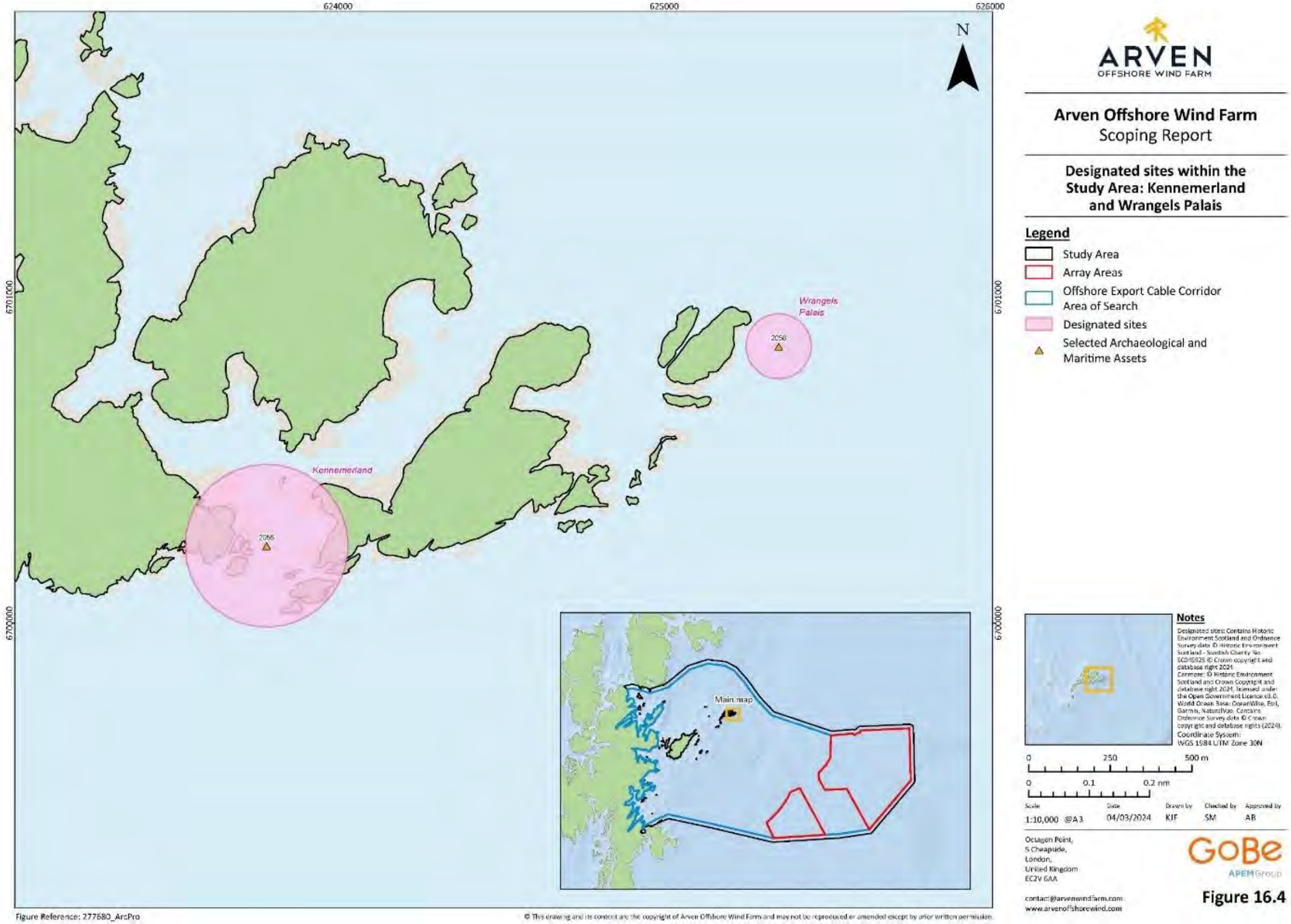
In summary, there is potential for the discovery of prehistoric and historic remains and artefacts of all periods along this coastline, together with potential for more recent remains associated with the Second World War defences and maritime activity across the eastern seaboard of Shetland.

16.4.5 Designated Sites

There are two sites located within the OfECC that have statutory designations under the Marine (Scotland) Act 2010 (Figure 16.4). These are the wrecks of the *Kennemerland* (**WA 2055; UKHO 111**) and *Wrangels Palais* (**WA 2058; UKHO 144**) which are located within the Out Skerries Historic Marine Protected Area (hMPA). The hMPA is not continuous between the two wrecks, with the hMPA around *Kennemerland* being 250 m in diameter around the central point and the hMPA around *Wrangels Palais* being 100 m.

The *Kennemerland* was a Dutch East Indiaman which struck Stoura Stack at the South Mouth entrance to Out Skerries harbour in 1664. Extensive research work has been completed on the wreck over the last 50 years and the wreck, alongside that of the *Wrangels Palais,* demonstrates the post-medieval maritime trading networks between Europe and the rest of the world, and the impact of this trade on Shetland and the wider area.

The *Wrangels Palais* was a Danish warship lost at Lamda Stack, 1.7 km further east on Out Skerries, in July 1687. Along with the other wrecks within the study area these demonstrate the importance of the sea routes passing around Shetland and the international potential of the area.



ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

Designated sites within the Study Area: Kennemerland and Wrangels Palais

Legend

- Study Area
- Array Areas
- Offshore Export Cable Corridor Area of Search
- Designated sites
- Selected Archaeological and Maritime Assets

Notes

Designated sites: Contains Historic Environment Scotland and Ordnance Survey data © Historic Environment Scotland - Scottish Charity No SC045925 © Crown copyright and database right 2024.
Canmore: © Historic Environment Scotland and Crown Copyright and database right 2024, licensed under the Open Government Licence v3.0.
World Ocean Base: DeLorme, Esri, Garmin, NaturalVue. Contains Ordnance Survey data © Crown copyright and database rights (2024).
Coordinate System: WGS 1984 UTM Zone 30N

0 250 500 m
0 0.1 0.2 nm

Scale	Date	Drawn by	Checked by	Approved by
1:10,000 @A3	04/03/2024	KIF	SM	AB

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Figure 16.4

Figure 16.4: Designated sites within the Study Area: Kennemerland and Wrangels Palais

There are no known sites located within the study area that have statutory designations under the Protection of Military Remains Act 1986 (PMRA 1986) or the Ancient Monuments and Archaeological Areas Act 1979. If crash sites and material from crashed military aircraft within the study area are encountered, they would automatically be legally protected under the PMRA 1986.

16.5 Embedded Mitigation

As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented below and, in the Commitments, Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

- C-1: Development of and adherence to a CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.
- C-17: Development of and adherence to an OMP. The OMP will describe operation and maintenance activities and provide an indicative schedule for the undertaking of these.
- C-19: Development of and adherence to a Written Scheme of Archaeological Investigation (WSI). The Marine Archaeological WSI will include the implementation of a Protocol for Archaeological Discoveries (PAD) in accordance with 'Protocol for Archaeological Discoveries: Offshore Renewables Projects' (The Crown Estate, 2014).
- C-20: Scour protection. Where there is the potential for scour to develop around infrastructure (foundations, moorings and cables).
- C-37: Seabed preparation, installation activities and installed infrastructure will avoid any identified seabed heritage assets and anthropogenic geophysical anomalies through the implementation of Archaeological Exclusion Zones (AEZs) and described in the WSI.

To support the collation of the WSI (designed-in measure C-19 and C-37), an archaeological review of existing geotechnical datasets will be conducted so that the marine historic assets can be identified and avoided. A geophysical survey campaign within the Array Areas or along the Offshore ECC will not be completed pre-consent submission as part of the baseline characterisation process due to detailed acoustic surveying, DDV and other camera footage having previously been completed for the whole of the Pobie Bank Reef SAC. A full detailed geophysical survey campaign will however be completed post consent for the Array Area and preferred Offshore ECR to further inform the final design concepts of the Offshore Proposed Development.

The production of a marine archaeological WSI, will be undertaken in line with 'Historic Environment Guidance for Offshore Wind Farm Projects' (The Crown Estate, 2021) and a Protocol for Archaeological Discoveries (PAD) for items of archaeological interest will be recommended, to manage potential impacts.

As a result of the commitment to implement these measures, and to align the Offshore Proposed Development with various standard sectoral practices and procedures, the embedded mitigations are considered inherently part of the design of the Offshore Proposed Development and have, therefore, been included in the assessment presented in Section 16.6.

The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon marine archaeology and cultural heritage and will be consulted upon with statutory consultees throughout the EIA process.

16.6 Scoping of Impacts

16.6.1 Potential Impacts Scoped In

Table 16.5 sets out an initial assessment of the likelihood of effects on marine archaeology and cultural heritage due to Offshore Proposed Development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the Offshore Proposed Development at the scoping stage; embedded mitigation (as set out in Section 16.5, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for marine archaeology and cultural heritage effects due to Offshore Proposed Development activities; relevant policy; and the professional judgement of qualified archaeological specialists.

Potential impacts on marine archaeology and cultural heritage have been identified which may occur during the construction, O&M, and decommissioning phases of the Offshore Proposed Development.

Table 16.6: Impacts scoped into the assessment of Marine Archaeology and Cultural Heritage

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction & Decommissioning			
Loss of, or damage to, known and unknown marine historic environment assets from direct impacts (intertidal, seabed prehistory, maritime and aviation archaeology).	Construction of the OfECC and other infrastructure that impact on the seabed have the potential to result in the damage/loss of known archaeological features and unknown archaeological features, which may lie undiscovered on or below the surface of the seabed, if any are present. Similar effects may be expected from vessel jack-up or anchoring systems that impact the seabed, or the removal of devices and other infrastructure in ways that disturb the seabed during decommissioning activities. Effects are considered to be permanent.	Scoped in. Archaeological assessment of marine geophysical and geotechnical datasets to establish the baseline character for marine archaeology and cultural heritage receptors.	C-1 (CaP), C-14 (DP), C-19 (WSI), C-37 (AEZs)
Indirect disturbance to marine historic environment assets caused by cable burial methods and /or cable protection	Indirect impacts to known and potential seabed prehistory, maritime and aviation assets caused by changes to the hydrodynamic and sedimentary regimes due to sediment redistribution.	Scoped in. Review of Seabed Processes assessment and archaeological assessment of marine geophysical and geotechnical datasets to establish the baseline character for marine archaeology and cultural heritage receptors.	C-1 (CaP), C-14 (DP), C-19 (WSI), C-20 (Scour Protection), C-37 (AEZs)

Operation and Maintenance			
Loss of or damage to known and unknown marine historic environment assets from direct impacts (intertidal, seabed prehistory, maritime and aviation archaeology).	Any of the device designs, cables and other infrastructure on the seabed or in the water column above that result in localised scouring have the potential to result in the damage/loss of known and unknown archaeological features lying on the seabed, if such assets are shown to be present. Maintenance vessel jack-up or anchoring systems that impact the seabed, or the repeated removal and replacement of devices and other infrastructure in ways that disturb the seabed also have the potential to result in the damage/loss of any archaeological features lying on the seabed. Effects are considered to be permanent.	Scoped in. Assessment conducted prior to Construction phase above.	C-17 (OMP), C-19 (WSI), C-37 (AEZs)
Indirect disturbance to marine historic environment assets caused by additional cable protection used during repair and maintenance	Indirect changes to known and potential seabed prehistory, maritime and aviation assets caused by changes to hydrodynamic and sedimentary regimes may expose receptors leading to increased rates of deterioration through biological, chemical and physical processes.	Scoped in. Assessment conducted prior to Construction phase above.	C-17 (OMP), C-19 (WSI), C-20 (Scour Protection), C-37 (AEZs)

16.6.2 Potential Impacts Scoped Out

No potential impacts have been scoped out at this stage.

16.7 Potential Cumulative Impacts

Chapter 4: EIA Methodology details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For marine archaeology and cultural heritage, cumulative interactions may occur with other seabed development such as offshore wind farms, oil and gas infrastructure, undersea cables and pipelines.

Impacts that are scoped into the assessment for the Offshore Proposed Development alone are generally spatially restricted to being within close proximity to the Array Areas and OfECC.

The CIA for marine archaeology and cultural heritage will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4: EIA Methodology.

16.8 Potential Transboundary Impacts

The process by which potential transboundary impacts will be assessed is described in Chapter 4: EIA Methodology.

No transboundary impacts on marine archaeology and cultural heritage receptors are anticipated to occur as a result of the Offshore Proposed Development activities during construction, O&M or decommissioning. Any predicted impacts on these pathways will largely be localised to within the study area and will not give rise to effects on the marine environment beyond UK waters. Therefore, it is proposed to scope out transboundary impacts with regards to marine archaeology and cultural heritage.

16.9 Proposed Approach to EIA

16.9.1 Relevant Guidance

In addition to the general approach and guidance outlined in Chapter 4: EIA Methodology, the assessment of marine archaeology and cultural heritage receptors will also comply with the following guidance documents where they are specific to this topic:

- Code of Practice for Seabed Developers (The Joint Nautical Archaeology Policy Committee and Crown Estate, 2006);
- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology & George Lambrick Archaeology and Heritage, 2008);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);
- Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes (Plets, Dix and Bates, 2013);
- Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021);

- Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014;
- Standards and guidance for historic environment desk-based assessment (Chartered Institute for Archaeologists (CIfA), 2014); and
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland (Historic Environment Scotland and Scottish Natural Heritage, 2018).

As the Offshore Proposed Development is located within Scottish territorial waters and the UK EEZ, there is policy to consider in relation to the marine historic environment. These are outlined below and will also be considered in relation to the marine archaeology and cultural heritage Offshore EIA:

- UK MPS was jointly published by all UK Administrations in March 2011 as part of a new system of marine planning being introduced across UK seas. The MPS sets out the framework for preparing Marine Plans and making decisions affecting the marine environment. The MPS also states that Marine Plans must ensure a sustainable marine environment that will protect heritage assets.
- Scotland's National Marine Plan: A Single Framework for Managing Our Seas (March 2015) covers both Scottish inshore waters (out to 12 nm) and offshore waters (12 to 200 nm). It contains policies and advice concerning the marine historic environment, including that development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance and that as well as designated marine heritage assets there are likely to be a number of undesignated sites of demonstrably equivalent significance, which are yet to be fully recorded or await discovery.
- Scotland's National Marine Plan also recommends that Marine Planning Partnerships and licensing authorities should seek to identify significant historic environment resources at the earliest stages of planning or development process and preserve them in situ wherever feasible. Adverse impacts should be avoided, or, if not possible, minimised and mitigated. Where this is not possible licensing authorities should require developers to record and advance understanding of the significance of the heritage asset before it is lost, in a manner proportionate to that significance.
- The Historic Environment Policy Statement for Scotland (HEPS) 2019 includes policies that decisions affecting any part of the historic environment require understanding of its significance and consideration of avoiding or minimising detrimental impacts.
- Designation Policy and Selection Guidance (HES, 2019, updated in 2020) stands alongside HEPS 2019 and outlines the principles and criteria that underpin the designation of Historic Marine Protected Areas (hMPAs).

16.9.2 Anticipated Additional Data Sources at EIA

A more detailed literature review will be developed for the EIA baseline, building upon the high-level outline provided within this Offshore Scoping Report. The desk-based study will include collation of any further data or information that may become available.

It is proposed that a detailed geophysical survey campaign of the Offshore Proposed Development will not be undertaken to inform EIA and that existing side scan sonar / multibeam echosounder (and DDV and camera footage) survey data gathered across Pobie Bank SAC during JNCC-led surveys will be used to support impact assessment where relevant. A geophysical (side scan sonar, sub-bottom profiler, multi-beam echosounder, magnetometry) and geotechnical (vibrocore and borehole logs) survey campaign will be completed post consent for the Array Areas and refined OfECC to further inform the final design concepts of the Offshore Proposed Development and confirm the presence, location and status of any features of archaeological importance to enable development of a robust WSI and PAD.

16.9.3 Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report.

An assessment will be conducted to identify known and unknown marine archaeology and cultural heritage receptors within the Array Areas and OfECC. It would also seek to define the potential for further marine archaeology and cultural heritage assets to be present in the study area. The desk-based assessment would be conducted to appropriate professional standards (CIfA, 2014 and as updated). The importance of receptors would be evaluated to inform the assessment of impacts. The level of importance assigned depends on a number of factors, including intrinsic, contextual and associative characteristics. This will be based on:

- Designation Policy and Selection Guidance (HES, 2019, updated 2020);
- Ships and Boats: Prehistory to Present. Designation Selection Guide (English Heritage, 2012); and
- Assessing Boats and Ships 1860-1913, 1914-1938 and 1939-1950 (Wessex Archaeology, 2011).

The assessment would address the identification of any marine historic assets on the seabed, so that avoidance of receptors can be embedded in the project design where possible, and if avoidance is not possible, then an evidence-based approach will be used to design suitable mitigation strategies in consultation with MD-LOT and key historic environment stakeholders, HES and Shetland Amenity Trust archaeological advisors.

For any marine archaeology impacts scoped in, the assessment will be based on analysis of desk-based sources (including GIS based gazetteer). It is intended that geophysical site-specific survey is undertaken post-consent to inform the final design. Any geophysical and geotechnical data collected specifically for the Offshore Proposed Development will inform the baseline characteristics to underpin the WSI. The assessment of the magnitude of impact and the significance of effect on marine historic environment assets will be based on HES and SNH's Environmental Impact Assessment Handbook (2018). Specific detailed methodology for the historic environment will be agreed in consultation with statutory stakeholders and curators.

16.10 Scoping Questions

The following Scoping questions refer to the marine archaeology and cultural heritage chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area (s) defined for Marine Archaeology and Cultural Heritage?
- Do you agree with the use of those data listed in Section 16.3, and any additional anticipated data listed in Section 16.9.2, being used to inform the Offshore EIA?
- Do you agree with the recommendation for reviewing any available marine geophysical and geotechnical surveys to enhance the baseline historic marine environment?
- Have all potential impacts on Marine Archaeology and Cultural Heritage resulting from the Offshore Proposed Development been identified within this Scoping Report?
- Do you agree that the embedded mitigations proposed for the Offshore Proposed Development will provide suitable means by which to manage and mitigate the potential effects of the Offshore Proposed Development on the marine historic environment?
- Do you agree with the proposed study areas identified for the Marine Archaeology and Cultural Heritage receptors?

- Do you agree with the scoping in of impact pathways in relation to Marine Archaeology and Cultural Heritage?
- Do you agree with the proposed assessment methodology for Marine Archaeology and Cultural Heritage?
- Do you agree to the scoping out of the assessment of transboundary effects in relation to Marine Archaeology and Cultural Heritage?
- A site-specific geophysical survey campaign is not proposed for completion prior to the consent application being submitted and therefore EIA will be informed by the results of thorough desk-based assessment. Do you agree that EIA can be robustly undertaken without the need for site-specific geophysical survey data. It is intended that geophysical and geotechnical site-specific survey is undertaken post-consent and that archaeological analysis of this data will inform the WSI and PAD.

17 Other Marine Users and Infrastructure

17.1 Introduction

This chapter covers all other users of the marine environment and infrastructure that may be impacted by the Offshore Proposed Development that have not already been covered by the previous chapters. These receptors include other offshore renewable energy projects, subsea cables and pipelines, non-aviation military activity, oil and gas assets, aquaculture, dredging activity and disposal sites.

This chapter should be read alongside the following chapters:

- Chapter 13: Commercial Fisheries;
- Chapter 14: Aviation and Radar;
- Chapter 15: Shipping and Navigation; and
- Chapter 18: Socioeconomics, Tourism and Recreation.

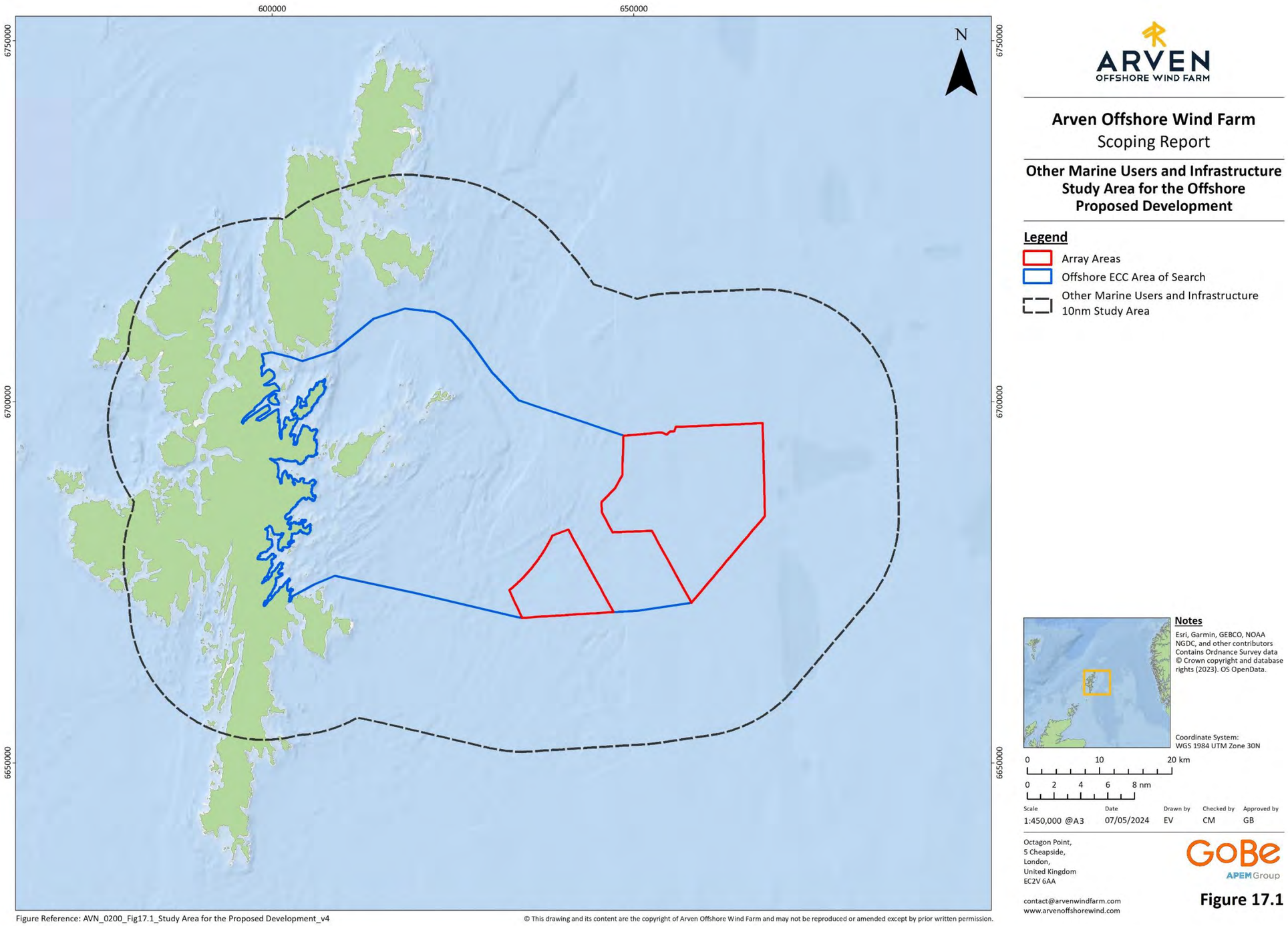
This scoping chapter has been prepared by GoBe Consultants.

17.2 Study Area

The Other Marine Users and Infrastructure (OMUI) study area is defined by the Offshore Proposed Development Boundary (Array Areas, OfECC study area) as well as a 10 nm buffer. The study area is presented in Figure 17.1.

17.3 Data Sources at Scoping

For the purposes of this Offshore Scoping Report a desk-based review of existing and known/recorded activities was undertaken using relevant spatial and scientific data sources. No site-specific surveys related to OMUI have been carried out to inform this Offshore Scoping Report. Consultation with other users of the study area will be an important source of data within the EIAR and initial consultation is ongoing with relevant stakeholders (e.g. Shetland aquaculture interests) (displayed in Chapter 5; Consultation) and will continue to further inform the EIA process. Table 17.1 provides the data sources that have been used to inform this Other Marine Users chapter.



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Other Marine Users and Infrastructure Study Area for the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- Other Marine Users and Infrastructure 10nm Study Area

Notes

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Coordinate System:
WGS 1984 UTM Zone 30N

0 10 20 km
0 2 4 6 8 nm

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Figure 17.1

Figure Reference: AVN_0200_Fig17.1_Study Area for the Proposed Development_v4

Figure 17.1: Other Marine Users and Infrastructure Study Area for the Offshore Proposed Development

Table 17.1: Data sources used to inform this OMUI scoping chapter

Title	Summary	Source	Year and Author
The Marine Scotland National Marine Plan Interactive (NMPi) Maps	Online, interactive GIS-based tool.	https://marinescotland.atkinsgeospatial.com/nmpi/	2021 Marine Scotland
Scotland's National Marine Plan	Plan covering the management of Scotland's inshore and offshore waters.	https://www.gov.scot/publications/scotlands-national-marine-plan/	2015 Scottish Government
Sectoral Marine Plan: Regional Locational Guidance	Regional spatial baseline data for the sectoral marine plan for offshore wind energy	https://www.gov.scot/publications/sectoral-marine-plan-regional-locational-guidance/pages/5/	2020 The Scottish Government
GIS Data Map for Offshore O&G Activity	Publicly available GIS data, details on the oil and gas licencing rounds and UK oil and gas activity.	https://www.arcgis.com/apps/webappviewer/index.html?id=f4b1ea5802944a55aa4a9df0184205a5	2023 North Sea Transition Authority (NSTA)
KIS-ORCA Dataset	Publicly available GIS data that details on offshore renewable energy infrastructure and cables,	https://kis-orca.org/map/	2023 Kingfish division of Seafish
Scotland's Aquaculture Spatial Data	Online, interactive GIS-based tool on aquaculture activity in Scotland	http://aquaculture.scotland.gov.uk	2021 CES

17.4 Baseline Environment

The baseline characteristics of OMUI within the study area have been identified from the data sources included in Table 17.1 above. This desk-based review provided the understanding of the marine environment surrounding the Offshore Proposed Development in relation to OMUI. The initial findings of the review are set out in the following sections. The key OMUI receptors and activities that show overlap with the Offshore Proposed Development OMUI study area identified include:

- Offshore renewable energy (wind, wave and tidal marine infrastructure);
- Subsea cables and utilities (telecommunication and subsea power cables);
- Marine dredging and disposal activities;
- Oil and Gas infrastructure; and
- Aquaculture.

17.4.1 Offshore Renewable Energy

17.4.1.1 Offshore Wind

ESB Asset Development was awarded a seabed option agreement within the Plan Option NE1, off the east coast of Shetland, for an offshore wind farm development following the CES ScotWind clearing process. ESB's proposed project (now named 'Stoura') is a floating offshore wind farm located 5.1 km north of the Offshore Proposed Development with a generating capacity of 500MW (ESB, 2023). The offshore wind project is displayed in Figure 17.2.

There is no current overlap of the Stoura OWF with the Offshore Proposed Development, however Stoura OWF is located within the study area and the Developer is involved with ongoing engagement with ESB in relation to potential grounds of common interest.

17.4.1.2 Wave and Tidal

CES are responsible for leasing areas of the Scottish seabed that are suitable for installation of wave and tidal arrays, and for managing the associated seabed rights. There is one tidal energy array project present within the OMUI scoping study area. The developer of this project is Nova Innovation.

Nova Innovation secured a seabed lease in 2022 from the CES to develop a tidal energy array at Yell Sound in Shetland. The Yell Sound Array is a 15 MW tidal array located between the islands of Yell and Bigga, 46.3 km from the Array Areas.

The Shetland Tidal Array is located in the Bluemull Sound, Shetland just offshore from the Ness of Cullivoe and between the islands of Yell and Unst, 52.2 km from the Offshore Proposed Development Array Areas. The project is just outside the OMUI study area. The turbines are located in water between 30-40 m depth and are not visible from the surface.

The offshore tidal projects are displayed in Figure 17.2.

17.4.1.3 Innovation and targeted Oil and Gas (INTOG)

INTOG is a leasing round for offshore wind projects that intends to reduce emissions from oil & gas production as well as directly boosting further innovation. In March 2023, 13 INTOG projects were awarded Exclusivity Agreements by CES. None of these projects are located within the OMUI scoping study area (CES, 2023).

INTOG NEb, is the closest area where INTOG projects may be considered on future leasing rounds, at 63.2 km from the Array Areas, however no projects are currently awarded within this area.

17.4.2 Subsea Cables and Utilities

The subsea power and telecommunication cables within the OMUI scoping study area are presented below in Figure 17.2.

17.4.2.1 Telecommunication cables

In 2021 the Scottish Government committed to enabling access to superfast broadband to every home in Scotland through the Reaching 100% programme (R100). Through the R100 North contract, subsea cables were constructed in 2022 to improve the connectivity to Scotland's Island communities. Two of these subsea cable routes are within the Offshore Scoping Boundary and one within the OMUI scoping study area. These are displayed in Figure 17.2:

- Within the Offshore Scoping Boundary:
    - R100 Seg 02 Telecom Cable – Mainland, Shetland to Yell;
    - R100 Seg 08 Telecom Cable – Mainland, Shetland to Whalsay; and
- Within the OMUI scoping study area:
    - R100 Seg 01 Telecom Cable – Yell to Unst.

17.4.2.2 Power cables

There are a number of interconnector power cables within the Offshore Proposed Development and the OMUI scoping study area. Most of these include small power cables, that connect the Shetland islands together. The power cables in the Offshore Proposed Development are described below and demonstrated in Figure 17.2:

- Whalsay to the Outer Skerries(SSEN);
- Mainland, Shetland to Whalsay (SSEN);
- Mainland, Shetland to Whalsay 2, via west Linga (SSEN);
- Mossbank to Yell North 1 (SSEN);
- Mossbank to Yell South 2 (SSEN);

The power cables in the OMUI study area are described below and demonstrated in Figure 17.2:

- Yell to Fetlar 1 – decommissioned (SSEN);
- Yell to Fetlar 2 (SSEN);
- Lerwick to Bressay (SSEN); and
- Clift Sound Power Cable (SSEN).

The Shetland High Voltage Direct Current (HVDC) Link is a 253 km subsea cable between Noss Head in Caithness and Weisdale Voe in Shetland (Figure 17.2). Construction for the link is currently underway from

Noss Head to the Orkney Islands. The cable is within the OMUI study area. At its closest point, the cable is at 10.9 km from the Offshore Scoping boundary (SSE 2022).

The Rosebank FPSO is a proposed electrification interconnector from the Rosebank offshore oilfield to landfall at the south of Mainland, Shetland. At its closest point, the interconnector is at 3.3 km across land from the Offshore Scoping boundary.

A HVDC interconnector has been proposed to connect Shetland with Norway. The Maali interconnector would offer the opportunity for energy produced in Shetland to be exported, and for energy to be imported when supply on the Shetland Islands is unable to meet demand. There is some potential for the Maali interconnector to intersect with the OMUI study area, however it is currently in the early planning stages and no detailed route is available to be reviewed.

17.4.3 Military and Defence Activity

The MoD operates in Scotland's coastal areas and sea and carry out training activities as well as surveillance and monitoring of the offshore area and interests from potential threats. In and around the Shetland Islands there are limited defence activities, with the only assets being communications and training or volunteer estate on the islands themselves. There are no MoD exercise and danger areas (PEXAs) or firing areas in the vicinity of the offshore OMUI study area; the location of the most proximate PEXAs is shown in Chapter 14: Aviation and Radar.

17.4.4 Oil and Gas Infrastructure

The oil and gas (O&G) industry is vital to the Shetland Islands, as the industry has played a significant role in the local economy for the past 40 to 50 years. The Offshore Proposed Development is located on the United Kingdom Continental Shelf (UKCS) and in the northern North Sea (NNS) where a substantial array of fixed surface infrastructure is present, mainly to the northeast of the Offshore Proposed Development (the East Shetland Basin) (DTI 2004). As the majority of O&G fields on the UKCS are in a mature stage of development, decommissioning processes over the next 20 to 30 years is an area of growing importance (DECC 2016). Therefore, there will be potential for the decommissioning of these O&G structures to overlap with the lifecycle of the Offshore Proposed Development. This is especially true as the Lerwick decommissioning yard (part of deep-water Lerwick harbour at Dales Voe), is present within the OMUI study area.

There is currently no offshore surface infrastructure present or proposed within the OMUI study area, and the study area does not overlap with any of the provisional 31st Round awarded proposed licence blocks.

There is a major landfall for O&G subsea pipelines at Sullom Voe on Mainland, Shetland which receives oil from fields in the northern North Sea and to the north and west of Scotland (Figure 17.2). The associated pipeline networks cross the OMUI study area.

17.4.4.1 Pipelines

The OMUI study is crossed by several O&G pipelines.

The Ninian Short Water Crossing is present within the Offshore scoping boundary and connects Grutwick Mol to Sullom Voe. The active gas SIRGE Pipeline System connects the Sullom Voe Terminal on Mainland, Shetland to the FUKA pipeline which connects at the St Fergus Gas Terminal on the East Coast of Scotland (NSMP 2023). The SIRGE Pipeline system is located 1.4 km west of the Array Areas at its closest point. An additional two oil pipelines cross the OMUI study area, north of the Offshore Proposed Development (Cormorant A to Sullom Voe and Ninian to Grutwick Mol). The Laggan-Tommore Gas Pipeline, the WOS and EOS and the Clair to Sullom Voe pipelines cross the OMUI study area, to the north-east of the Offshore Proposed Development. The O&G infrastructure within the OMUI study area are presented in Figure 17.2.

17.4.4.2 Subsea Structures

There are a number of subsea structures present within the Offshore Scoping boundary displayed on Figure 17.2. These structures are composed of cable protection for the Cormorant A to Sullom Voe and SIRGE O&G pipelines. The structures include concrete mattresses and rock bags.

17.4.4.3 Carbon Capture and Storage

Carbon Capture Storage (CCS) is one of the methods used by the Scottish Government to aid the policy of decarbonising electricity generation by 2030. CCS is intended to prevent certain industrial-scale sources of human-generated carbon dioxide (CO2) from being released into the atmosphere. The development of the industry is currently centered around the north and northeast regions. There are no current or potential CCS storage areas or saline aquifers present or planned within the OMUI study area.

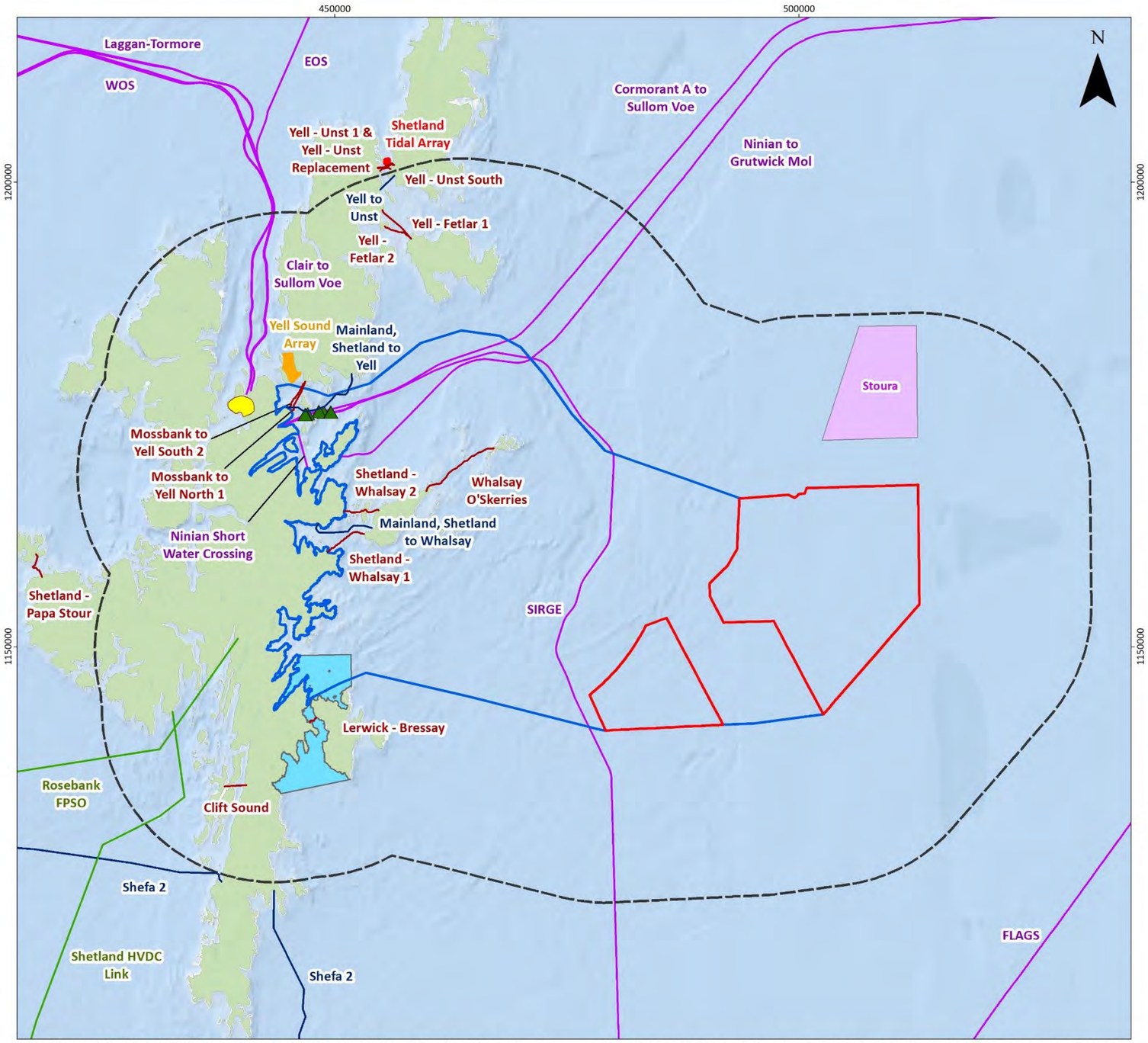

Figure Reference: AVN_0200_Fig17.2_Offshore Renewable Developments, Subsea Cables and Oil and Gas Infrastructure_v5

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Offshore Wind and Tidal Sites, Subsea Cables and Oil and Gas Infrastructure Including Pipelines in the Vicinity of the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- Other Marine Users and Infrastructure 10nm Study Area
- Sullom Voe Boundary
- Lerwick Harbour
- Stoura Offshore Wind Farm (Early Planning)
- Oil and Gas Pipelines (Active)
- Subsea Structure (Active)

Tidal Sites

- In Planning
- Operational

Subsea Cables (Label)

- Power - Active
- Power - Proposed
- Telecom - Active

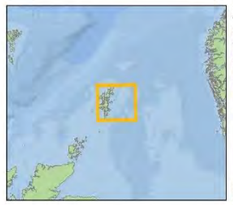

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Figure 17.2

Figure 17.2: Offshore Wind and Tidal Sites, Subsea Cables and Oil and Gas Infrastructure Including Pipelines in the Vicinity of the Offshore Proposed Development

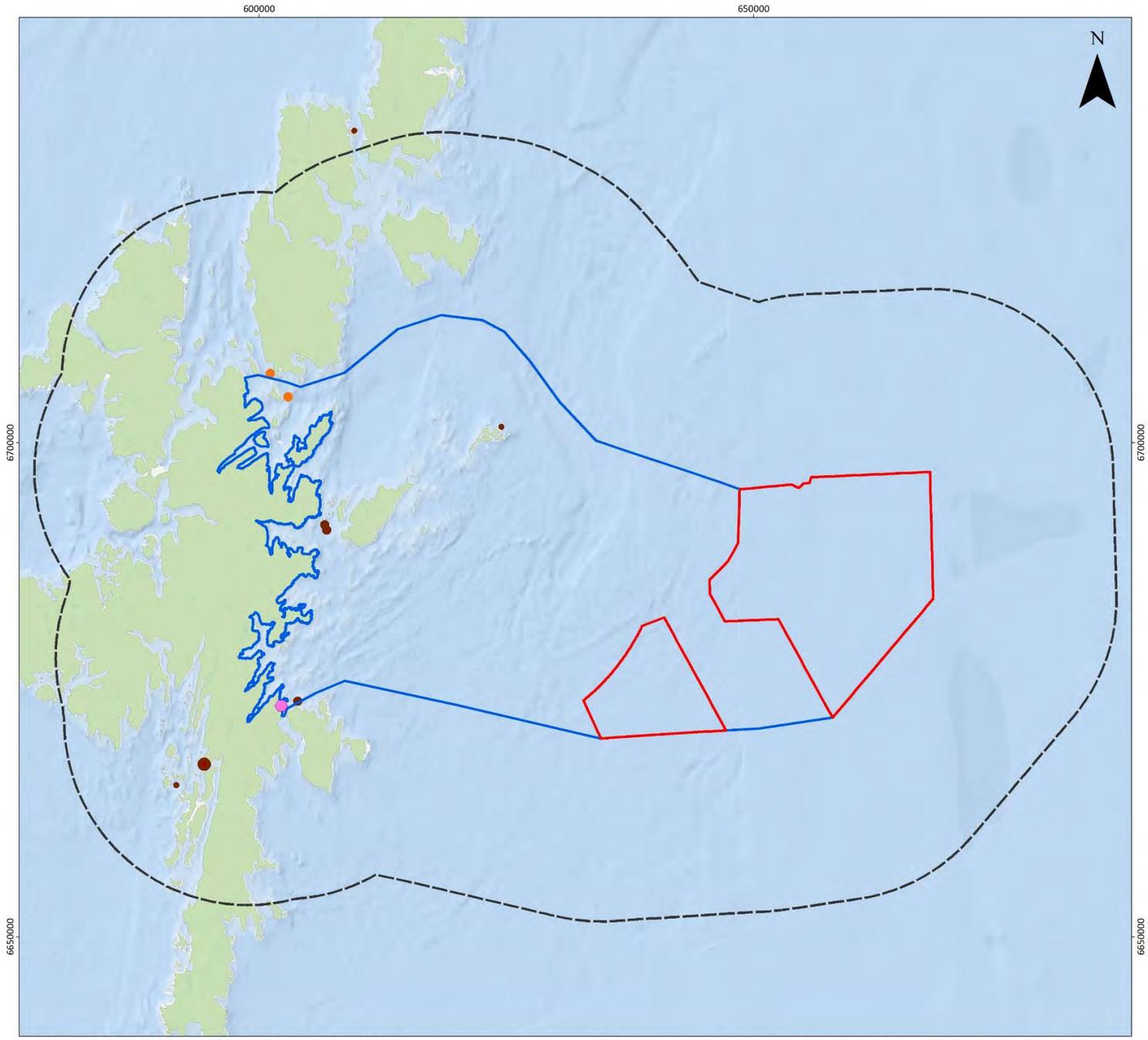
17.4.5 Marine Dredging and Disposal

Within the OMUI study area there are eight marine licensed dredging spoil deposit sites, with two open disposal sites and six closed sites. Five of these sites are within the Offshore Scoping boundary (four closed and one open), and one open site is adjacent to the boundary. These are identified in Table 17.2 and displayed in Figure 17.3. Spoil dredging sites are necessary due to navigational dredging (deepening of navigation channels) on the approaches to ports and harbours. No marine aggregate extraction is licensed within the OMUI study area.

Table 17.2: Dredging Spoil deposit sites identified within the OMUI study area

Name	Status	Distance from Array Areas (km)
Skerries	Closed	24.1
Lerwick	Closed	28.5
Symbister	Closed	30.9
Symbister A	Closed	31.7
Punds Voe	Closed	38.8
Toft	Open	42.0
Scalloway	Closed	42.0
Ulsta	Open	44.5

There is one wastewater treatment plant (WwTP) identified within the OMUI study area. This is a WwTP with a capacity of 15,000 to 100,000 Population Equivalent (PE) located in Lerwick, Rova Head Quarry, Shetland displayed in Figure 17.3.



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Disposal Sites and Wastewater Treatment Plant in the Vicinity of the Offshore Proposed Development

Legend
- Array Areas
- Offshore ECC Area of Search
- Other Marine Users and Infrastructure 10nm Study Area
- Rovahead Wastewater Treatment Plant

Disposal Sites (Status)
- Open Disposal Sites
- Closed Disposal Sites

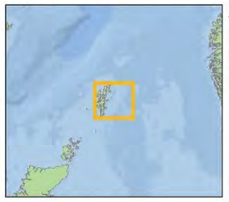

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Figure 17.3

Figure Reference: AVN_0200_Fig17.3_Disposal Sites and Wastewater Treatment Plant_v7

Figure 17.3: Disposal Sites and Wastewater Treatment Plant in the Vicinity of the Offshore Proposed Development

17.4.6 Aquaculture

Shetland continues to make a significant contribution to Scotland's growing aquaculture industry. With exports including edible mussels and salmon. Approximately 25% of Scottish salmon and 80% of Scottish mussels are produced in the Shetland Isles (UHI 2023). As aquaculture is a large industry within the Shetland Islands the OMUI study area comprises 132 active shellfish aquaculture sites, and 56 active saltwater finfish aquaculture sites. Within the Scoping boundary itself there are 14 finfish sites, and 20 shellfish sites. These are typically located in sheltered inshore and nearshore waters. The marine aquaculture sites present within the OMUI study area are shown in Figure 17.4 .

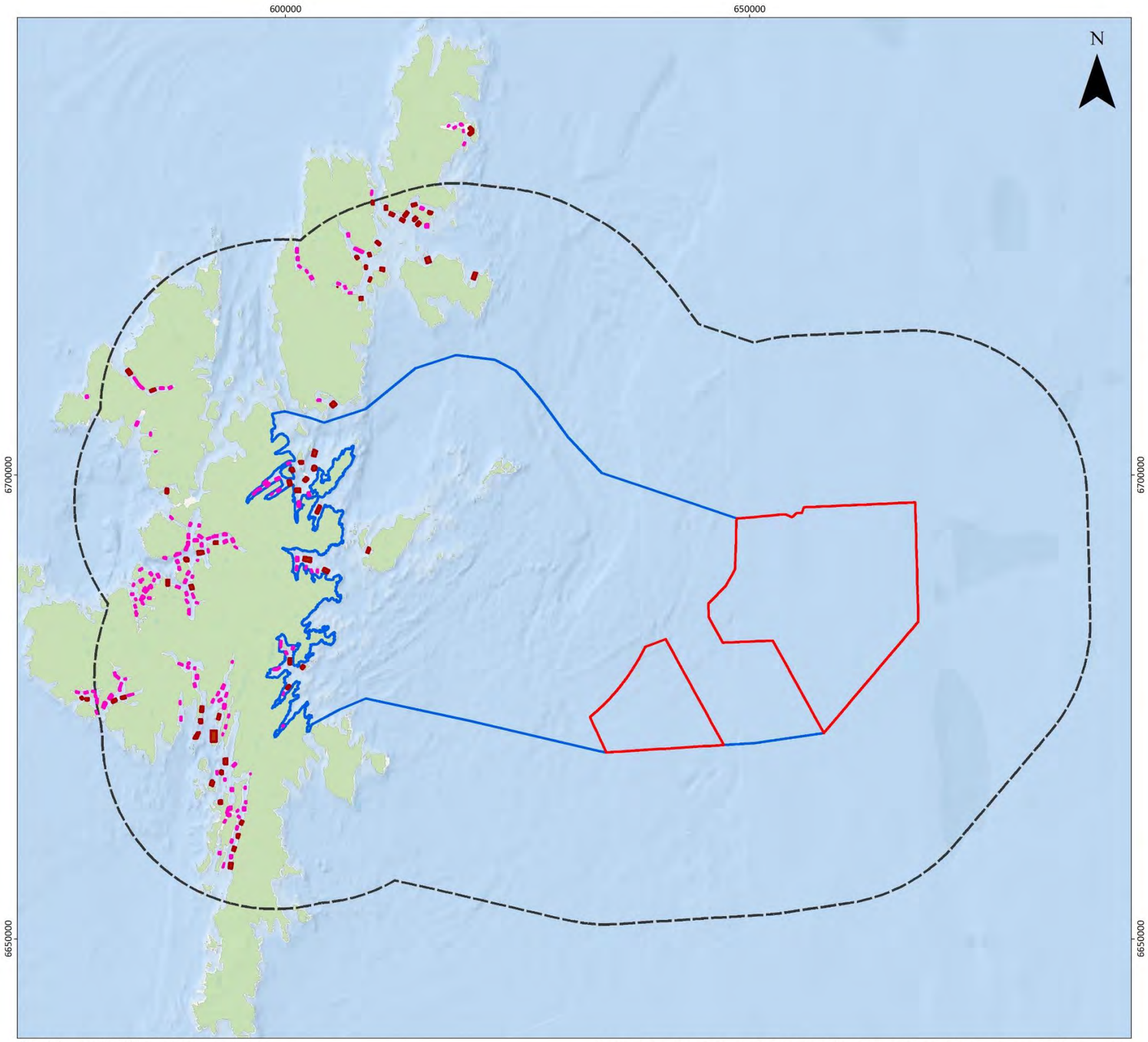
17.4.7 Other

17.4.7.1 Charter Angling

Charter angling involves fishing recreationally from fishing boats that are for hire and that come with a captain or guide and sometimes crew. This kind of sea fishing activity is popular in Shetland waters, with several charter companies operating locally to offer fishing opportunities for a range of species including cod, haddock, ling, monkfish and mackerel. Recognised fishing locations include wrecks and other marks, in and around locations including Bressay Sound, Eshaness and West Burrafirth (Sea Fishing Adventurer 2024).

17.4.7.2 Nuclear

No new nuclear power stations will be built in Scotland as part of the UK government's plans to boost energy independence, as was confirmed in April 2022.



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Aquaculture Sites in the Vicinity of the Offshore Proposed Development

Legend

- Array Areas
- Offshore ECC Area of Search
- Other Marine Users and Infrastructure 10nm Study Area
- Aquaculture Finfish Sites
- Aquaculture Shellfish Sites

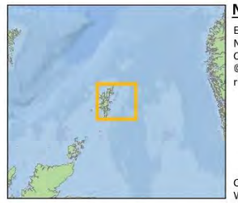

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Figure 17.4

Figure Reference: AVN_0200_Fig17.4_Aquaculture Sites_v7

Figure 17.4: Aquaculture Sites in the Vicinity of the Offshore Proposed Development

17.5 Embedded Mitigation

Throughout the design and development process of the Offshore Proposed Development, mitigation measures will be considered. As part of the initial design process, embedded mitigation measures are proposed in order to reduce the potential environmental effects of development. Measures related to OMUI are as follows:

- C-1: Development of and adherence to a CaP. The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring;
- C-4: Development of and adherence to a CMS. The CMS will confirm construction methods and the roles and responsibilities of parties engaged in construction. It will detail any construction-related mitigation measures;
- C-6: Development of and adherence to an EMP. The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: Chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management;
- C-9: Development of and adherence to a MPCP. The MPCP will identify potential sources of pollution and associated spill response and reporting procedures;
- C-10: Development of and adherence to a NSP. The NSP will describe measures put in place by the Project related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Project activity to other sea users (e.g. via Notice to Mariners);
- C-16: Development of and adherence to a LMP. The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting;
- C-18: Development of and adherence to an ERCoP. The ERCoP will be prepared in line with MCA guidance and confirms what measures the Project has in place to support any emergency response;
- C-22: Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins;
- C-24: Application for and use of Safety Zones of up to 500m during construction, maintenance and decommissioning phases. Where appropriate, guard vessels will also be used to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards;
- C-27: Marine coordination and communication to manage Project vessel movements;
- C-28: Any objects dropped on the seabed during works associated with the Project will be reported and objects will be recovered where they pose a hazard to other marine users and where recovery is possible; and

17.6 Scoping of Impacts

17.6.1 Potential Impacts Scoped In

The potential impacts from the Offshore Proposed Development throughout its lifecycle that may affect OMUI assets, have been identified in Table 17.3.

Table 17.3: Impacts scoped into the assessment of Other Marine Users and Infrastructure

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction and Decommissioning Phases			
Temporary obstruction to other OWFs	The study area overlaps with the array areas and potential ECC of the Stoura OWF (currently unknown). Thus, there is potential to obstruct activities necessary to their development or the need to cross their offshore export cables.	Desktop study supported by consultation with stakeholders.	C-1 (CaP); C-4 (CMS); C-10 (NSP); C-22 (Warning and location of construction, decommissioning and safety zones); C-24 (Safety zones); C-27 (project vessel management).
Temporary obstruction to tidal renewable energy activities and developments	The study area overlaps with one or more tidal renewable energy projects. Thus, there is potential to obstruct activities necessary to their development or the need to cross their offshore export cables.	Desktop study supported by consultation with stakeholders.	C-4 (CMS); C-10 (NSP); C-22); C-22 (Warning and location of construction, decommissioning and safety zones); C-27 (project vessel management).
Temporary obstruction to subsea cables and utilities activities and developments	The study area overlaps with telecommunication cables and power cables that connect the Shetland Isles. Therefore, there is potential for disruption to the activities of this development.	Desktop study supported by consultation with stakeholders.	C-1 (CaP); C-10 (NSP); C-18 (ERCoP); C-22 (Warning and location of construction, decommissioning and safety zones); C-24 (Safety zones); C-28 (Dropped objects).
Temporary obstruction to marine dredging and disposal activities	There are two open dredge spoil deposit sites within the OMUI study area. There is potential for disruption to the activities of this development.	Desktop study supported by consultation with stakeholders.	C-1 (CaP); C-4 (CMS); C-22 (Warning and location of construction, decommissioning and safety zones); C-27 (project vessel management); C-28 (Dropped objects).

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Temporary obstruction to Oil and Gas activities and developments	Due to the proximity to the O&G subsea pipelines and terminals on Mainland, Shetland there is potential for disruption to the activities of this development.	Desktop study supported by consultation with stakeholders.	C-10 (NSP); C-16 (LMP); C-18 (ERCoP); C-22 (Warning and location of construction, decommissioning and safety zones); C-24 (Safety zones); C-27 (Project vessel management).
Temporary obstructions to aquaculture activities	There are 188 aquaculture sites within the study area, thus, there is potential for disruption to these activities.	Desktop study supported by consultation with stakeholders.	C-4 (CMS); C-6 (EMP); C-9 (MPCP); C-22 (Warning and location of construction, decommissioning and safety zones).
Operation and Maintenance Phase			
Temporary obstruction to other OWFs	The study area overlaps with the array area and potential ECC of the Stoura OWF (currently unknown). Thus, there is potential to obstruct activities necessary to their development or the need to cross their offshore export cables.	Desktop study supported by consultation with stakeholders.	C-1 (CaP); C-4 (CMS); C-10 (NSP); C-22 (Warning and location of maintenance and safety zones); C-24 (Safety zones); C-27 (Project vessel management).

17.6.2 Potential Impacts Scoped Out

The potential impacts from the Offshore Proposed Development to OMUI receptors that have been scoped out of further assessment are displayed in Table 17.4.

Table 17.4: Impacts proposed to be scoped out of further assessment for OMUI

Impact	Justification	Relevant Development Phase
INTOG	There are no INTOG developments within the study area	All phases
Wave Energy projects	There are no wave energy projects within the study area	All phases
CCS	There are no CCS activities within the study area	All phases
Nuclear	There are no nuclear activities within the study area	All phases
Charter Angling	The Offshore Proposed Development should not interact with Charter Angling sites as these are mobile sites and can avoid the Proposed Development when necessary.	All phases

17.7 Potential Cumulative Impacts

The process by which potential cumulative impacts will be assessed through the CIA is described in Chapter 4: EIA Methodology.

There is potential for the impacts as a result of the Offshore Proposed Development to interact with other proposed projects or infrastructure that could result in cumulative impacts on OMUI receptors. These projects and activities that could result in cumulative impacts with the Offshore Proposed Development include the Stoura OWF development, power and telecom cables, O&G pipelines, O&G coastal infrastructure and aquaculture sites. The cumulative OMUI impacts that will occur from the Offshore Proposed Development are anticipated to be localised and temporary around the offshore infrastructure but could occur at any stage of the Offshore Proposed Development.

The EIAR will assess how the above impacts will be considered for cumulative assessment. The CIA for OMUI will consider the maximum design scenario for each project plan or activity in question in line with the methodology outlined.

17.8 Potential Transboundary Impacts

There is potential for transboundary impacts upon the OMUI receptors during construction O&M and decommissioning as the Norwegian EEZ is associated with the proposed Maali HVDC interconnector between Shetland and Norway. As this project is currently in the early planning stages no detailed route for the interconnector is currently in place and consultation with the developer will be undertaken if deemed necessary to reduce the potential for transboundary impacts.

All other potential transboundary impacts for OMUI receptors have been scoped out at this stage as there is no pathway for effect anticipated.

17.9 Proposed Approach to EIA

17.9.1 Relevant Guidance

- Assessment of Impact of Offshore Wind Energy Structures on the Marine Environment (Marine Institute, 2000);
- European Subsea Cables Association (ESCA) Guideline No 6, The Proximity of Offshore Renewable Energy Installations and Submarine Cable Infrastructure in UK Waters (ESCA, 2016);
- International Cable Protection Committee (ICPC) recommendations (ICPC, 2021);
- Oil and Gas UK, Pipeline Crossing Agreement and Proximity Agreement Pack (Oil and Gas UK, 2015);
- The Crown Estate Guidance: Export transmission cables for offshore renewable installations - Principles of cable rerouting and spacing (The Crown Estate, 2012a); and
- The Crown Estate Guidance: Submarine cables and offshore renewable energy installation - Proximity study (The Crown Estate, 2012b).

In addition, any upcoming guidance in development will be used when appropriate.

17.9.2 Anticipated Additional Data Sources at EIA

In addition to the publicly available datasets outlined in Section 17.3, Table 17.1, a detailed literature review will be completed for the OMUI chapter for the EIAR, which will build on the outline provided within this Scoping Report. For the EIAR further consultation and stakeholder engagement will be set out and will be used as a primary source of information to identify the current and planned activities within the OMUI study area. For this to be effective consultees will include:

- Subsea cables operators;
- Marine Renewable Energy lease owners;
- Aquaculture developers/operators;
- Disposal site users;
- Charter angling skippers;
- O&G operators; and
- Spaceport operator.

17.9.3 Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report. The specific guidance documents set out above will be considered for the other marine users EIA chapter. Furthermore, any revised or upcoming guidance that is being developed that will be relevant to this chapter will be used when necessary. The potential impacts to OMUI receptors that are scoped into the EIAR

will be assessed using a desk-based review which will only consider the impacts where there is a risk of a LSE, in line with the EIA regulations. The desk-based review will consider the maximum design envelope of the Offshore Proposed Development for project-specific and associated cumulative impacts.

The EIA chapter will align with other chapters of the EIA when necessary, including Chapter 15: Shipping and Navigation, Chapter 18: Socioeconomics, Tourism and Recreation and Chapter 13: Commercial Fisheries.

17.10 Scoping Questions

The following scoping questions refer to the OMUI chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those data listed in Section 17.3, and any additional anticipated data listed in Section 17.9, being used to inform the Offshore EIA?
- Do you agree that all receptors related to OMUI have been identified?
- Do you agree with the scoping in and out of impacts related to OMUI?
- Do you agree with the suitability of the embedded mitigation measures we have considered and proposed for inclusion?
- Do you agree with the proposed study areas identified for the OMUI receptors?
- Do you agree with the proposed assessment methodology related to OMUI?
- Do you agree with the scoping in and out of transboundary effects related to OMUI?
- Do you agree with the proposed approach of the assessment of cumulative effects related to OMUI?

18 Socioeconomics, Tourism and Recreation

18.1 Introduction

This chapter of the Offshore Scoping Report considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Offshore Proposed Development on socioeconomic, tourism and recreation receptors. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on socioeconomics, tourism and recreation in the Offshore EIAR. The impacts associated with the onshore elements of the Project will be considered in the Onshore Scoping Report.

This chapter should be read alongside the following other chapters:

- Chapter 12: Seascape, Landscape and Visual Impact Assessment;
- Chapter 13: Commercial Fisheries;
- Chapter 15: Shipping and Navigation; and
- Chapter 17: Other Marine Users and Infrastructure.

This chapter of the Offshore Scoping Report for the Offshore Proposed Development has been prepared by BiGGAR Economics.

18.2 Study Area

The relevant study area s are onshore because the organisations, individuals and communities that might be impacted by the Offshore Proposed Development activities, are based in onshore communities, including coastal communities.

The socioeconomic study areas for the assessment of effects on employment and economy will be defined in line with the guidance on the identification of 'local areas' for offshore developments published by the Marine Directorate (Marine Directorate, 2022a). This guidance identified six principles for identifying local study areas for offshore developments:

- Principle 1 (Dual Geographies): The local area for the supply chain and investment impacts should be separate from the local area(s) for wider socioeconomic impacts, including tourism and recreation;
- Principle 2 (Appropriate Impacts): The appropriate impacts to be considered for assessments should be identified before defining the local areas;
- Principle 3 (Epicentres): The local areas should include all the epicentres of the appropriate impacts;
- Principle 4 (Accountability): The local areas used in the assessment should comprise of pre-existing economic or political geographies (community councils, local authorities, development agencies) to enhance accountability;
- Principle 5 (Understandable): The local areas should be defined in such a way that they are understandable to the communities they describe; and
- Principle 6 (Connected Geography): The local area for the supply chain and investment impacts should consist of connected (including coastal) pre-existing economic or political geographies.

The epicentres of impact associated with the infrastructure and activities for the Offshore Proposed Development will include the locations of the key construction and operations and maintenance ports, the location of any supply chain hubs or any locations on land with visibility of the offshore infrastructure. The Array

Areas will be located approximately 30 km east of Mainland, Shetland and will be visible in some locations (see Chapter 12: Seascape, Landscape and Visual Impact Assessment) (White Consultants, 2020). It is also currently anticipated that the landfall(s) will be in Shetland. Therefore, Shetland has been proposed as a local study area, noting that this will be confirmed and/or further defined in the EIAR if more information on the ports that will be used to support development are known.

The economic effects will also be assessed at the level of the Scottish and UK economies, which will be the study areas for the economic impact assessment. The study areas are defined in Figure 18.1

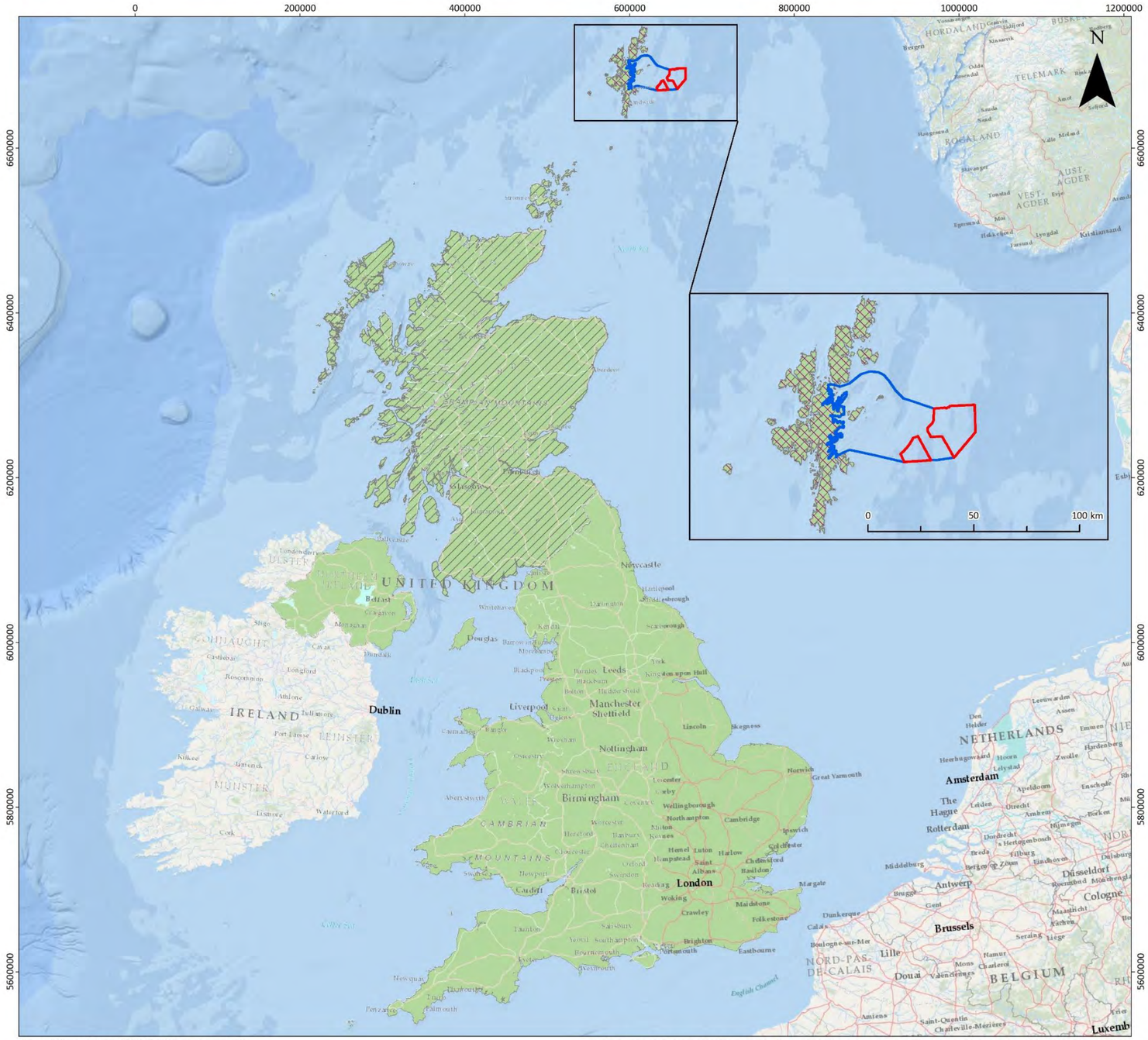

Figure Reference: AVN_0200_Fig18.1_Study Area_v2

ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

Socio-Economics Study Areas

Legend

- Array Areas
- Offshore ECC Area of Search
- Shetland Islands
- Scotland
- UK

Notes

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors Sources: Esri, Garmin, USGS, NPS Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System:
WGS 1984 UTM Zone 30N

0 100 200 300 km

0 50 100 nm

Scale	Date	Drawn by	Checked by	Approved by
1:4,500,000@A3	07/05/2024	EV	CM	GB

Octagon Point,
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GoBe
APEM Group

Figure 18.1

Figure 18.1: Socio-Economics Study Areas

The location of the primary construction port has not been identified at this stage and therefore there is potential for other locations to be epicentres of social and economic impacts.

For tourism and recreation, the primary focus will also be onshore activity that is affected by the development, construction, operation, and decommissioning of the offshore assets.

In addition, there will also be the potential for marine recreation to be affected by the construction, maintenance and decommissioning of the offshore export cable route, near the potential landfall location(s) in Shetland. These could occur if the vessels used during works impede the ability of marine recreation users to pursue these activities, including recreational sailing, wildlife watching or sea angling.

18.3 Data Sources at Scoping

Table 18.1: Data sources used to inform Socioeconomics Tourism and Recreation scoping chapter.

Title	Summary	Source	Author and year
Mid-2021 Population Estimates Scotland	Population estimates, broken down by age.	https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/mid-2021	National Records of Scotland (2022)
2020-based Principal Population Projections	Population projections for Scotland	https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-projections/population-projections-scotland/2020-based	National Records of Scotland (2023)
2018-based Principal Population Projections	Population projections for Scotland and each of its 32 local authorities, broken down by age.	https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-projections/sub-	National Records of Scotland (2020)

Title	Summary	Source	Author and year
		national-population-projections/2018-based	
Principal Populations 2018-Based	Population projections for the UK as a whole, broken down by age.	https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2018based	Office for National Statistics (ONS) (2019)
Annual Survey of Hours and Earnings 2022	Provides average and median residential and workplace earnings.	https://www.nomisweb.co.uk/datasets/asher	ONS (2023)
Business Register and Employment Survey 2021	Provides a breakdown of employment by sector.	https://www.nomisweb.co.uk/datasets/newbres6eul	ONS (2022)
Annual Population Survey 2022	Provides statistics on characteristics of populations, including economic activity rate and unemployment rate	https://www.nomisweb.co.uk/datasets/apsnew	ONS (2023)
Offshore Wind Skills Intelligence Report	Provides information on the existing offshore wind labour force across the UK as well as the skills that are expected to be needed up to 2030.	https://www.owic.org.uk/_files/ugd/1c0521_94c1d5e74ec14b59afc44cebe2960f62.pdf	Offshore Wind Industry Council (OWIC) (2023)
The Offshore Wind Operations & Maintenance: A £9 billion per year opportunity by 2030 for the UK to Seize	Discusses the potential opportunities in offshore wind by 2030, with a detailed breakdown of annual spending and associated opportunities in the UK.	https://ore.catapult.org.uk/wp-content/uploads/2021/05/Catapult-Offshore-Wind-OM_final-050521.pdf	Offshore Renewable Energy Catapult (2020)

Title	Summary	Source	Author and year
The Offshore Wind Sector Deal	Sets out the economic opportunities associated with offshore wind, including UK Government targets on the share of UK content.	https://assets.publishing.service.gov.uk/media/5c9e235740f0b625e647be07/BEIS_Offshore_Wind_Single_Pages_web_optimised.pdf	BEIS (2020)
National Performance Framework	Sets out a framework for what a successful country would look like, providing a range of measures to assess a proposed project against.	https://nationalperformance.gov.scot/	Scottish Government (2018)
National Strategy for Economic Transformation	Sets out the priorities for the Scottish economy, as well as how to achieve a well-being economy.	https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2022/03/scotlands-national-strategy-economic-transformation/documents/delivering-economic-prosperity/delivering-economic-prosperity/govscot%3Adocument/delivering-economic-prosperity.pdf	Scottish Government (2022)
National Planning Framework 4	Establishes a framework for spatial priorities in Scotland.	https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/02/national-planning-framework-4/documents/national-planning-framework-4-revised-draft/national-planning-framework-4-	Scottish Government (2023)

Title	Summary	Source	Author and year
		revised-draft/govscot%3Adocument/national-planning-framework-4.pdf	
Offshore Wind Policy Statement	Sets out the Scottish Government's ambitions for the future of offshore wind in Scotland.	https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/10/offshore-wind-policy-statement/documents/offshore-wind-policy-statement/offshore-wind-policy-statement/govscot%3Adocument/offshore-wind-policy-statement.pdf	Scottish Government (2020)
GB Tourism Survey 2019	Annual publication of domestic overnight tourism visits and nights by number, value, and purpose, with 2019 as the latest year not affected by Covid-19. May be updated before drafting the EIA.	https://www.visitbritain.org/media/1294/download?attachment	Kantar TNS (2020)
International Passenger Survey	Annual publication of international overnight tourism visits and nights by number, value, and purpose, with 2019 as the latest year not affected by Covid-19. May be updated before drafting the EIA.	https://www.visitbritain.org/research-insights/inbound-visits-and-spend-annual-uk	ONS (2020)

Title	Summary	Source	Author and year
Annual Growth Sector Statistics	Provides economic statistics, such as employment and GVA, on growth sectors identified by the Scottish Government, including sustainable tourism.	https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2019/07/growth-sector-statistics/documents/growth-sector-statistics-database/growth-sector-statistics-database/govscot%3Adocument/GS%2Bdatabase.xlsx	Scottish Government (2022)
Shetland Islands Visitor Survey 2019	Provides details of a survey of visitors to the Shetland Islands covering 2019, including the purpose and motivations of these trips	https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-insights/shetland-islands-visitor-survey-2019.pdf	VisitScotland (2020)

18.4 Baseline Environment

18.4.1 Socioeconomic Baseline

This section presents baseline socioeconomic statistics for each of the study areas, in particular how the Shetland Islands compare to the wider study areas.

18.4.1.1 Population Baseline

In 2021, the Shetland Islands had a population of 22,900, which is equivalent to 0.4% of the population of Scotland as a whole. The age profile of the Islands is older than that of Scotland, with a smaller proportion of the population aged 16 to 64 (61%) and a greater share of the population aged 65 and over (21%).

The population of the Shetland Islands has decreased by 1% since 2011, compared to a 3% increase in population across Scotland during this time. It is projected that this trend will continue, and that the population will decrease by 6% over the period to 2043. The population baseline is summarised in Table 18.2.

Table 18.2: Population Baseline

	Shetland Islands	Scotland	UK
Total Population	22,900	5,479,900	67,026,300
% under 16	18%	17%	18%

	Shetland Islands	Scotland	UK
% aged 16 – 64	61%	64%	63%
% aged 65 and over	21%	20%	19%
Population (2011)	23,200	5,299,900	63,285,100
Population Projection (2043)	21,579	5,503,019	72,121,453

18.4.1.2 Labour market baseline

The economic activity rate (i.e. the share of the population aged 16 to 64 that are either in employment or looking for a job) in the Shetland Islands is broadly in line with Scotland as a whole. However, one of the distinct characteristics of the labour market in Shetland is the proportion of the workforce that is aged 65 and over. Across the UK this has increased from 2% in 2004 to 4% in 2022. Shetland and other island communities have historically had a larger proportion of the population involved in the labour market and the latest estimates (ONS, 2023) are that 17% of the workforce in the Shetland Islands is aged 54 or over. This is the highest of all areas in the UK.

Table 18.3: Labour Market Baseline

	Shetland Islands	Scotland	UK
Economic Activity Rate	76%	77%	78%
Unemployment Rate	2%	3%	4%
Median Annual Gros Income	£30,544	£27,698	£27,756
Share of Workforce Aged 65 and Over	17%	3%	4%

18.4.1.3 Industrial Structure Baseline

The top three sectors of employment in the Shetland Islands are:

- Agriculture, forestry and fishing, which employs 19% of the workforce;
- Human health and social work activities, 14%; and
- Wholesale and retail trade, 11%.

The agriculture, forestry and fishing sector is particularly high in the Shetland Islands, across Scotland this sector supports 3% of jobs. This includes fishing and aquaculture, which accounts for 6% of employment. Fishing and aquaculture play a greater role in the labour market in the Shetland Islands than in any other local authority in Scotland.

The construction sector accounts for 8% of employment in the Shetland Islands, which is more than in Scotland as a whole (6%).

The tourism sector in the Shetland Islands accounts for a smaller share of employment than in Scotland as a whole. The accommodation and food service sector accounts for 5% of jobs in Shetland, compared to 7% of jobs across Scotland as a whole.

The socioeconomic baseline will be expanded in the EIA to add more detail on the indicators of sensitivity of each of the economic receptors and enable the relative magnitude of each impact to be quantified for each study area.

18.4.2 Tourism Baseline

As highlighted in the above section, the tourism economy in the Shetland Islands is less concentrated than in other areas of Scotland and the sector directly employs around 1,000 people in the area. In 2019 it was estimated that there were 80,000 visits to the Shetland Islands, with a total spend of £35.8 million (Visit Scotland, 2020).

The tourism and recreation baseline in the EIA will identify the tourism and recreation receptors in the Shetland Islands. It will identify the drivers for the success of these receptors and consider the role of tourism in the economy of the Shetland Islands in more detail.

18.5 Embedded Mitigation

As part of the initial design process, embedded mitigation measures have been developed in order to reduce the potential adverse environmental effects of development and to maximise any positive effects that are identified. Measures related to Socioeconomics, Tourism and Recreation are as follows:

- As part of the ScotWind process, the Developer has committed in the Arven Array Supply Chain Development Statement (Arven Offshore Wind Farm, 2023) and the Arven South Supply Chain Development Statement (Arven South Offshore Wind Farm, 2023) to maximise deliverable project expenditure primarily in Scotland (including locally in Shetland) and to provide in-kind support to the supply chain to address the present limited capability in Scotland (including Shetland) through:
- Early and continued engagement with the supply chain regarding the specifics of the project, aimed at improving project performance;
- Demonstration of trust and empowerment throughout the project life cycle;
- Sharing expected challenges and opportunities and requesting support from industry to provide solutions; and
- Promoting renewable careers by engaging schools and establishing scholarships, promoting offshore wind as a career of choice to attract those from other sectors and upholding the Sector Deal workforce values of equality, inclusivity and diversity.

Measures that will mitigate against effects on marine recreational vessels, including:

- C – 10 Development of and adherence to an NSP. The NSP will describe measures put in place by the Project related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Project activity to other sea users (e.g. via Notice to Mariners);
- C – 13 - Development of and adherence to a VMP. The VMP will confirm the types and numbers of vessels that will be engaged on the Project, and consider vessel coordination including indicative transit route planning. This will mitigate against potential effects on recreational sailing vessels;
- C – 16 - Development of and adherence to a LMP. The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting. This will mitigate against potential effects on recreational sailing vessels;
- C – 22 - Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins; and

- C – 27 - Marine coordination and communication to manage Project vessel movements.

18.6 Scoping of Impacts

Table 18.4 sets out the initial assessment of the potential impacts on socioeconomics, tourism, and recreation due to the construction, operation, and decommissioning of the Offshore Proposed Development.

The social impacts that are considered in this section are those defined in the general advice published by the Marine Analytical Unit of Marine Scotland in 2022 (Marine Scotland, 2022b). At the time of writing, the construction and operation ports, which are expected to be the main epicentres of impact, are not known and it is unlikely that these shall be confirmed at the time of the assessment. At the time of the assessment, it will however be possible to identify hypothetical areas of impact and undertake scenario planning for impacts at potential locations for the construction base and operation and maintenance base. It will not therefore be possible to be definitive about the nature and scale of the impacts affecting communities but information on impacts for several potential scenarios will be presented, including an overview of:

- What impacts may occur and at what scale;
- The sensitivity of the communities that these impacts may occur; and
- How these impacts may be felt across these communities.

Consideration has been given to taking a proportionate approach to undertaking social research required for the EIA, and how it will complement the community engagement activities that the Developer wishes to undertake outwith the EIA process.

18.6.1 Potential Impacts Scoped In

The impacts that have been scoped into the assessment are described in Table 18.4.

Table 18.4: Impacts scoped into the assessment of Socioeconomics, Tourism and Recreation

Impact	Description	Proposed Approach	Assessment	Embedded mitigation
Construction and Decommissioning				
Increase in employment and GVA.	Economic impacts associated with the expenditure of the Offshore Proposed Development and supply chain requirements	Desk based		Supply Chain Development Statement and wider stakeholder engagement.
Demographic changes.	Change in population and characteristics of population as a result of the Offshore Proposed Development.	Desk based		N/A
Changes to housing demand.	Change in level of demand for accommodation as a result of the Offshore Proposed Development and its demographic impacts.	Desk based		Stakeholder engagement, including with local authorities and sector bodies.
Changes to other local public and private services.	Change in level of demand for services as a result of the Offshore Proposed Development and its demographic impacts.	Desk based		Stakeholder engagement, including with local authorities and sector bodies.
Changes to commercial fisheries.	Potential disruption to the commercial fishing sector leading to changes in economic activity in the sector,	Desk based		Proposed embedded mitigation are outlined in Chapter 13: Commercial Fisheries.

Impact	Description	Proposed Approach	Assessment	Embedded mitigation
	including to upstream and downstream supply chains.			
Changes to tourism receptors.	The construction of the Offshore Proposed Development has the potential to influence visitor behavior, depending on the other environmental impacts that are generated	Desk based		N/A
Changes to shipping and marine recreation.	Changes to economic activity as a result of the Offshore Proposed Development may affect activity in the shipping and marine recreation sectors.	Desk based		Proposed embedded mitigation are outlined in Chapter 15: Shipping and Navigation and Chapter 17: Other Marine Users and Infrastructure, including C-10 (NSP), C-13 (VMP), C16 (LMP), C-22 (Warning of time and location of activities) and C-27 (project vessel management)
Operation and Maintenance				
Increase in employment and GVA.	Economic impacts associated with the expenditure of the Offshore Proposed Development and supply chain requirements.	Desk based		Supply Chain Development Statement and wider stakeholder engagement.
Demographic changes.	Change in population and characteristics of population as a	Desk based		N/A

Impact	Description	Proposed Approach	Assessment	Embedded mitigation
	result of the Offshore Proposed Development.			
Changes to housing demand.	Change in level of demand for accommodation as a result of the Offshore Proposed Development and its demographic impacts.	Desk based		Stakeholder engagement, including with local authorities and sector bodies.
Changes to other local public and private services.	Change in level of demand for services as a result of the Offshore Proposed Development and its demographic impacts.	Desk based		Stakeholder engagement, including with local authorities and sector bodies.
Changes to commercial fisheries.	Potential disruption to the commercial fishing sector leading to changes in economic activity in the sector, including to upstream and downstream supply chains.	Desk based		Proposed embedded mitigation are outlined in Chapter 13: Commercial Fisheries.
Changes to shipping and marine recreation.	Changes to economic activity as a result of the Offshore Proposed Development may affect activity in the shipping and marine recreation sectors.	Desk based		Proposed embedded mitigation are outlined in Chapter 15: Shipping and Navigation and Chapter 17: Other Marine Users and Infrastructure including C-10 (NSP), C-13 (VMP), C16 (LMP), C-22 (Warning of time and location of activities) and C-27 (project vessel management)

Impact	Description	Proposed Approach	Assessment	Embedded mitigation
Changes to tourism receptors.	The operation of the Offshore Proposed Development has the potential to influence visitor behavior, depending on the other environmental impacts that are generated	Desk based		N/A

18.6.2 Potential Impacts Scoped Out

It is proposed that the sociocultural effects, identified in the General Advice as a potential area of impact, are scoped out of EIA. This includes:

- Lifestyles/quality of life;
- Gender issues; family structure;
- Social problems (e.g. crime, ill-health, deprivation);
- Human rights;
- Community stress and conflict; integration, cohesion, and alienation; and
- Community character or image.

The assessment of these effects would require primary social research within the communities that will be impacted, in particular those that will experience the greatest demographic or employment effects. However, at the time of the assessment the locations of these communities will not be known as the primary construction and operational ports will not have been identified.

Consideration of such effects is better carried out strategically rather than on a project-specific basis and indeed in 2022, the Scottish Government published social research by the Diffley Partnership (Scottish Government 2022a) that considered the social impacts that coastal communities with experience of offshore wind farms have had. This research found that the net perception of these communities was that the offshore wind farms have had a positive impact on their quality of life, community relations and community character. However, most respondents felt that the offshore wind fam projects have had no impact on these sociocultural attributes. This is shown in Table 18.5, which shows that 63% of respondents felt the development of offshore wind projects had no impact on their quality of life, 59% felt it had no impact on community relations and 55% felt it had no impact on community character.

Table 18.5: Response from Coastal Communities to Questions Regarding Sociocultural Impacts of Offshore Wind Farms (excluding "Don't Knows")

What impact, if any, do you think that offshore wind farms in your area have had on…	**Total Positive Impact**	**No Impact**	**Total Negative Impact**	**Net Positive/ Negative**
…Quality of Life?	25%	63%	4%	+21%
…Community Relations?	16%	59%	7%	+9%
…Community Character?	21%	55%	9%	+12%

The general effect of offshore wind developments on these sociocultural attributes of coastal communities is therefore neither adverse nor significant. While there may be issues that are specific to the communities around the epicentres of impact that could result in significant or adverse effects, at the time of the assessment these locations are not likely to be known. Unlike the potential effects on demographics, housing and other services, the sociocultural effects are not so directly linked to the scale of the employment opportunities in each of the communities. As the location of the construction base and operation and maintenance base will not have been

determined at the time of drafting the Arven Offshore Wind Farm EIAR, it will not be possible to discuss the potential sociocultural effects beyond the general effect of offshore wind on coastal communities.

Impacts that are scoped into the EIAR are those which have the potential for significant effects. In particular, the Scottish Government states that:

> *"EIA is a tool used to assess the significant effects of a project or development proposal on the environment. EIAs make sure that project decision makers think about the likely effects on the environment at the earliest possible time and aim to avoid, reduce or offset those effects." (Scottish Government, 2022b)*

It is therefore proposed that sociocultural effects are scoped out of the assessment for the EIAR. This is because:

- The sociocultural effects are generally neither adverse nor significant; and
- The communities that will experience these sociocultural effects cannot be definitively identified at the time of assessment. Therefore, it is not considered proportionate to conduct primary social research in all areas that may have the potential to host activities associated with the Arven Offshore Wind Farm regarding:
    - Perceptions of impact;
    - Sensitivities of communities to any of the changes; and
    - The relative magnitude in any change that would be required to identify significant adverse effects.

Table 18.6: Impacts proposed to be scoped out of further assessment for Socioeconomics

Impact	Justification
Construction; Operation and Maintenance and Decommissioning	
Sociocultural	Impacts are generally neither adverse nor significant

18.7 Potential Cumulative Impacts

For socioeconomics, tourism and recreation, cumulative interactions may occur with other ScotWind and INTOG projects and other large capital projects.

There is the potential for the impacts identified in Table 18.4 to interact with other projects particularly other offshore wind farms being developed as part of the ScotWind and INTOG leasing rounds, and other significant capital projects in the area. Cumulatively, the development of the ScotWind projects are expected to represent a substantial increase in demand at the Scottish level for the industries that will be involved in the construction of these projects.

As one of potentially many offshore wind projects, the Offshore Proposed Development will contribute to the cumulative case for potential local or inward investment by making it more financially attractive to set up new manufacturing and fabrication facilities in Scotland, as opposed to relying on overseas facilities that may have

higher transportation costs. Consideration will also be given to the cumulative effects on port facilities during the construction and operation and maintenance phases.

The decommissioning timetable of other capital projects, particularly offshore wind projects, is not known at this stage, and the main constraint on this activity will be the port infrastructure. The baseline assessment of port capabilities and constraints is likely to change over time as ports invest in new facilities to feed the decommissioning demand. Therefore, it is proposed that the CIA will not consider decommissioning impacts.

The process by which potential cumulative impacts will be assessed through the CIA is described in Chapter 4: EIA Methodology.

18.8 Potential Transboundary Impacts

The following transboundary effects have been identified as potential occurrences resulting from activities associated with the Offshore Proposed Development construction, operation and maintenance, and decommissioning:

- Socioeconomic effects taking place outside of the UK, relating to non-UK supply chain during the construction, operation, and decommissioning phases. These will be imports from outside of the UK, and are expected to be positive in nature however it is not known which countries the supply chain will be based and therefore it is not possible to assess the significance of the effects; and
- Effects on commercial fisheries and other marine users based outside of the UK during construction, operation, and decommissioning.

These will not be considered as part of the socio-economic impact assessment because the economic impacts will be dependent on the properties of the national economies where this activity occurs. At this stage of the assessment, it will not be known what these countries will be and therefore it will not be possible to reliably model these impacts and therefore it is not possible to assess the significance of the effects.

Therefore, these impacts have been scoped out of this assessment.

18.9 Proposed Approach to EIA

18.9.1 Relevant Guidance

The guidance most relevant to the assessment includes:

- General Advice for Socioeconomic Impact Assessment (Marine Scotland, 2022b);
- Defining 'Local Areas' for assessing impacts of offshore renewables and other marine developments: Guidance Principles (Marine Scotland, 2022a); and
- Green Book - Central Government Guidance on Appraisal and Evaluation (HM Treasury, 2022).

In addition to the guidance documents listed above, the Scottish Government is in the process of developing guidance on the assessment of the socioeconomic impacts of offshore wind energy projects. It is expected that this will be published prior to the submission of the EIA. This guidance will be considered, and it is assumed that it will build on the General Advice document that was published in 2022.

18.9.2 Anticipated Additional Data Sources at EIA

A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. This may include information published by the ONS, National Records of Scotland and Scotland's Census, which is expected to be published before the publication of the EIA.

18.9.3 Assessment Methodology

The assessment methodology for Socioeconomics, Tourism and Recreation will follow the approach outlined in Chapter 4:EIA Methodology. Further detail on the specific approach to assessment for this topic is provided below.

18.9.3.1 Economic Impact Methodology

To assess the socioeconomic effects of the Offshore Proposed Development, the focus will be on the direct and indirect (supply chain) effects, in line with the UK Offshore Wind Sector Deal (BEIS 2020). In addition to this, the assessment will also consider the effects of staff spending and the economic impact that this subsequent increase in demand stimulates (the induced effect).

The economic impacts will be considered for each study area and will be reported in terms of:

- GVA: this is a measure of economic value added by an organisation, industry or region and is typically estimated by subtracting the non-staff operational costs from the turnover of an organisation;
- Years of Employment: this is a measure of employment which is equivalent to one person being employed for a year and is typically used when considering short to medium term employment impacts, such as those associated with the construction phase of the Offshore Proposed Development; and
- Jobs: this is a measure of employment which considers the headcount employment in an organisation or industry. This measure is used when considering long term impacts such as the jobs supported during the operation and maintenance phase of Offshore Proposed Development.

The socioeconomic assessment will consider the lowest, realistic levels of expenditure associated with the Offshore Proposed Development, since that would represent the 'worst case' scenario in terms of the expected positive socioeconomic effects. This will take account of the 'Commitment' scenario in the Supply Chain Development Statement Outlook (SCDS) submitted as part of the ScotWind leasing process (Arven Offshore Wind Farm, 2023), though may be revised to reflect subsequent revisions of the SCDS which will take account of any changes or developments in the local supply chain.

The impact assessment will take account of deadweight, leakage, displacement, and substitution. Sensitivity analysis will also be undertaken to account for risk, uncertainty, and optimism bias, where they could have implications for the economic impacts.

The offshore elements will include the construction and installation of fixed or floating foundations and turbines, the offshore substations and the construction and installation of new inter-array and interconnector cabling, and export cable to landfall. The onshore elements will include the construction and installation of the landfall, onshore export cable route and onshore substation.

The analysis for the Offshore Proposed Development will cover three phases:

- Development and construction;

- Operation and maintenance; and
- Decommissioning.

The impacts during the construction phase will be based on the actual expenditure that has occurred to date as well as the planned expenditure associated with this phase. In addition to the total impact over the period, the assessment will also consider the timings of impacts during this phase to understand the peaks and troughs of this activity.

The impacts during the operation and maintenance phase for the Offshore Proposed Development will be based on projected operational (including maintenance) expenditure.

In instances where impacts are expected to occur over several years, such as the operation and maintenance phase or the decommissioning phase, a discount rate will be applied. This allows impacts that occur sooner to be valued more highly than impacts that occur in the future, a concept known as time preference. In this instance, a discount rate of 3.5% will be chosen, which is in line with the UK Government's Green Book. On this basis, it is expected that the decommissioning phase impacts will be substantially lower than for the construction phase.

18.9.3.2 Social Impact Assessment Methodology

To avoid the negative impacts of the SEIA process itself, consultation will be limited to key stakeholders (such as local authorities). The methodology aims to minimise disruption to communities through over-consultation and ultimately seeks to avoid reputational damage to the Offshore Proposed Development, its Developer, the offshore sector in general, and the Scottish Government's consenting processes.

More details on why location is particularly important in understanding how impacts are felt across communities are provided in this section, particularly around the factors that influence the sensitivity of the communities that will be affected.

This section outlines the methodology that will be applied to potential impacts that have been scoped into the assessment.

18.9.3.3 Tourism and Recreation Impacts

The assessment will also consider the potential for tourism and recreation impacts. Studies have found that the presence of energy infrastructure itself does not have an effect on tourism and recreation assets, rather how visitors react to the other environmental effects that are caused by this infrastructure. For example, if the construction results in marine vessel restrictions that deter marine recreation visitors from coming to the area. The tourism and recreation assessments will be based on the sensitivity of the tourism economy, or assets in each area and the magnitude of any potential change in behaviour.

The tourism and recreational baseline will identify receptors in the Shetland Islands and map these against any significant effects identified for other relevant topics of the EIAR. If significant effects are identified on these receptors, the tourism assessment will consider if the receptors are sensitive to the particular environmental effect identified.

The assessment of recreational effects will be similar and will apply the NatureScot guidance on sensitivity and magnitude of recreational assets to those receptors that will experience significant environmental effects.

18.9.3.4 Demographics

The employment that will be created as a result of the Offshore Proposed Development will have demographic impacts if this employment helps to retain or attract people to the communities where this activity occurs. The potential impacts of demographic change will be assessed as far as possible, including the scale of any impact and its potential to be significant.

As the port location(s) for activities associated with the Offshore Proposed Development will not have been determined at the time of drafting the EIAR, the assessment will consider the potential scale of employment opportunities at the potential locations of the construction base and the operation and maintenance base.

The sensitivity of each of the demographic receptors will be determined by the trends in demographics in the potential host communities and projections estimated for how these demographics will change over time, and how the demographics of the workforce would relate to different communities. The magnitude of any demographic change will be determined by the change relative to the current population.

18.9.3.5 Housing

The potential impacts on housing are one of the key topics that coastal communities are concerned about. The demographic changes that result from the employment opportunities have the potential to change the level of demand for housing.

As with the demographic impacts, potential effects on housing will vary considerably between communities. The sensitivity of any housing market to changes in demand because of the Offshore Proposed Development will be determined by factors including:

- The population of the community, including the wider travel to work area;
- The availability of housing or other accommodation within the community;
- The scale of the overnight tourism sector in the community;
- The ability of the housing market to adjust supply to respond to changes in demand; and
- The relative level of housing affordability in the area.

Similarly, the magnitude of any change will be determined by the peak level of additional accommodation demand in each area, relative to the baseline accommodation provision. The magnitude of any change in housing demand would also be determined by the demographic changes as a result of the Offshore Proposed Development. This would be determined by the baseline labour supply in each of the potential areas and the relative size of any transient labour population.

It is expected that the largest demographic, and therefore housing impacts will be those associated with the construction and operational ports. As location(s) for activities associated with the Offshore Proposed Development will not have been determined at the time of drafting the EIAR, the assessment will consider the potential scale of additional housing demand that will occur during the peak periods of employment in areas identified as potential locations for activities associated with the Offshore Proposed Development.

18.9.3.6 Other Local Services

As with the housing market, the demographic changes that could result from the employment opportunities, could result in changes to the level of demand for other services. This will include:

- Public and private sector services;
- Educational services;
- Health services and social support;
- Police, fire, recreation, transport; and
- Local authority finances

The assessment of the effect on these services will also be determined by factors of sensitivity that will be specific to the potentially impacted communities. This will include the capacity of each service in each of the potential areas and the ability of the service to adapt to changes in demand.

The magnitude will also be determined by the relative demographic change in each potential area, which will vary based on the size of the population and the availability of labour in each of the study areas.

As with the impacts on housing, it is anticipated that the main impacts on other local services will occur around the epicentres of the primary construction port. As the location of the construction base and operation and maintenance base will not have been determined at the time of drafting the EIAR, the assessment will consider the potential scale of additional demand on other services that will occur during the peak periods of employment based on the potential demographic effects in each potential host area and the propensity of each demographic group to use each of the services listed.

18.10 Scoping Questions

The following scoping questions refer to the socioeconomics, tourism and recreation chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those data listed in Section 18.3, and any additional anticipated data listed in Section 18.9, being used to inform the Offshore EIA?
- Do you agree that all receptors related to Socioeconomics, Tourism and Recreation have been identified?
- Do you agree with the scoping in and out of impacts related to Socioeconomics, Tourism and Recreation?
- Do you agree with the suitability of the embedded mitigation measures we have considered and proposed for inclusion?
- Do you agree with the proposed study areas identified for the Socioeconomics Tourism and Recreation receptors?
- Do you agree with the approach to scope out transboundary effects related to Socioeconomics, Tourism and Recreation?
- Do you agree with the approach to the assessment of cumulative effects related to Socioeconomics, Tourism and Recreation?
- Do you agree with the proposed approach to the assessment methodology related to Socioeconomics, Tourism and Recreation?

19 Climate Change and Greenhouse Gas

19.1 Introduction

This chapter of the Offshore Scoping Report examines the climate receptors of relevance to the Offshore Proposed Development. The chapter considers the potential impacts of the Offshore Proposed Development associated with climate change receptors and identifies the potential impacts arising from the pre-construction, construction, O&M and decommissioning phases of the Offshore Proposed Development.

For the purposes of this Offshore Scoping Report and subsequent EIAR, the consideration of climate change effects is divided into the following three individual climate change assessments:

- Impact of the Offshore Proposed Development on climate (GHG emissions): this assessment will consider the impact on the climate of GHG emissions arising from the Offshore Proposed Development during its lifecycle compared to the current and future baseline GHG emissions, including how the Offshore Proposed Development will affect the ability of the Government to meet its planned carbon reduction targets. Mitigation measures will be identified throughout the assessment to reduce GHG emissions during the life cycle of the Offshore Proposed Development;
- The Climate change resilience (CCR) assessment of the Offshore Proposed Development: will consider future climate change risks, and possible impacts to the Offshore Proposed Development that are identified from these risks; and
- In-combination climate change impacts (ICCI): this assessment will identify the influence of climate change on the combination of impacts related to the Offshore Proposed Development with receptors in the environment that result in significant impacts within the scope of the EIA which are not present under current climate conditions.

The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (from 0-12 nm) and the Marine Works (Environmental Impact Assessment) Regulations 2007 (12-200 nm) introduced climate change as a new topic, broadening the potential scope of an EIA and require the impact that the project will have on climate to be assessed alongside an assessment of the project's vulnerability to climate change to be included in the EIAR in relation to climate change.

The Climate Change (Scotland) Act 2009 requires the preparation of strategic programmes for climate change adaptation. The second Scottish Climate Change Adaptation Programme (SCCAP) was published in 2019. The SCCAP aims to build resilience of Scotland's people, environment and economy to the impacts of climate change, and outlines how Scotland is preparing for the impacts of climate change over the period to 2024. Progress on the programme is reported annually. The Scottish Government will develop a new five-year climate change adaptation programme during the Offshore Proposed Development consent period and will be followed throughout this process.

This chapter should be read alongside the following other Chapters:

- Chapter 4: EIA Methodology;
- Chapter 15: Shipping and Navigation; and
- Chapter 17: Other Marine Users and Infrastructure.

This chapter of the Offshore Scoping Report was prepared by GoBe Consultants.

19.2 Study Area

The study area that applies to each type of assessment is set out below:

19.2.1 GHG Assessment

The spatial study area is the local environment (Shetland Islands) and the national environment (Scotland) (Figure 19.1) for the GHG emissions assessment and includes sources and removals of GHG emissions arising from construction and operation of the Offshore Proposed Development, as set out in Table 19.1.

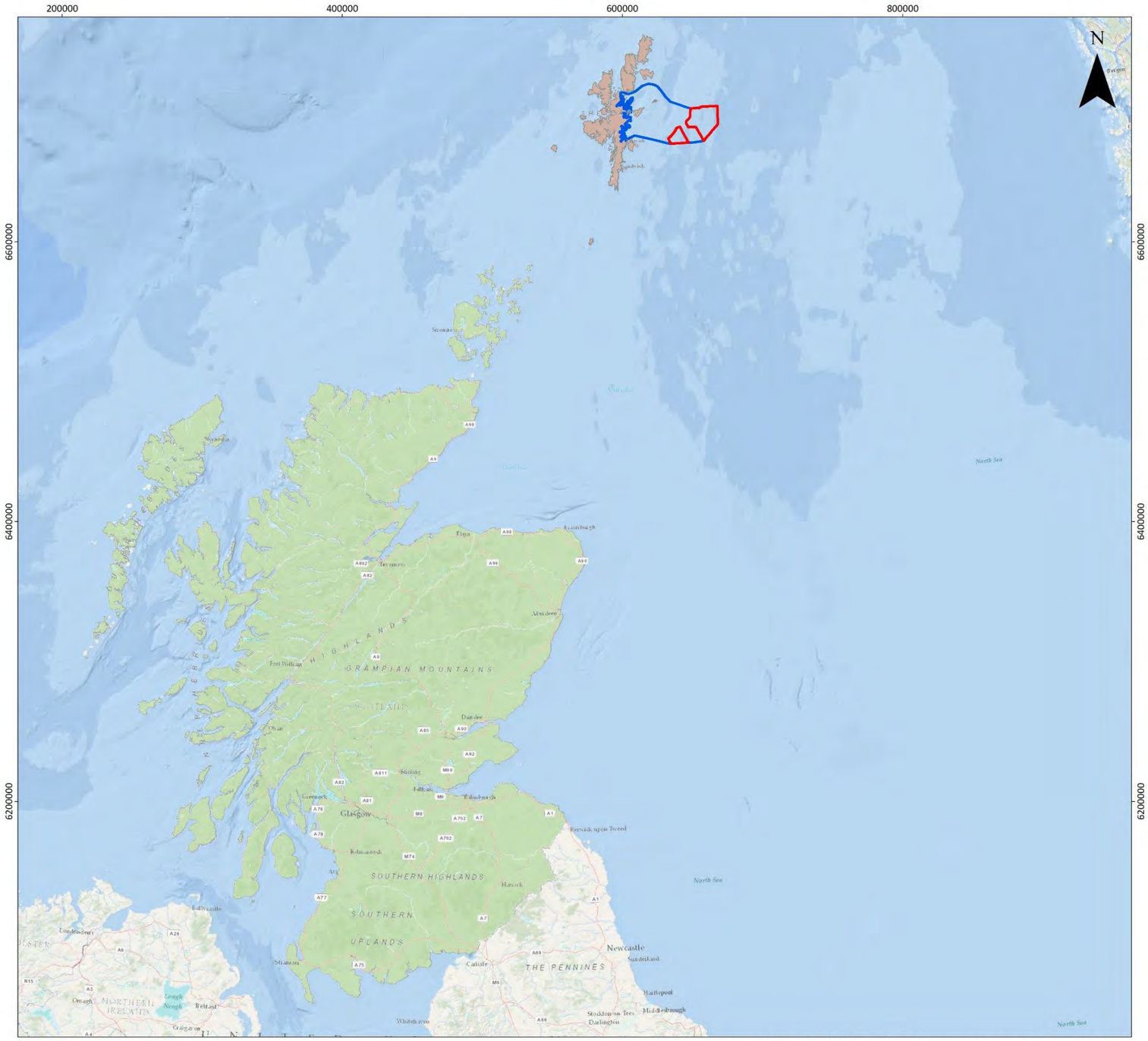

Figure Reference: AVN_0200_Fig19.1_Study Area_v2

ARVEN
OFFSHORE WIND FARM

Arven Offshore Wind Farm
Scoping Report

Air Quality and Climate Study Areas

Legend

- Array Areas
- Offshore ECC Area of Search
- National Environment Study Area
- Local Environment Study Area

Notes

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors Sources: Esri, Garmin, USGS, NPS Contains Ordnance Survey data © Crown copyright and database rights (2023). OS OpenData.

Coordinate System:
WGS 1984 UTM Zone 30N

0 60 120 180 km

0 25 50 nm

Scale	Date	Drawn by	Checked by	Approved by
1:2,650,000@A3	05/03/2024	EV	CM	GB

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APEM Group

Figure 19.1

Figure 19.1: Air Quality and Climate Study areas

Table 19.1: Sources of GHG emissions arising from Lifecycle stages of the Offshore Proposed Development

Lifecycle stage	Activity	Primary emission sources
Pre-construction	Vessels	GHG emissions arising from the fuel used by vessels used for surveys.
Construction	Materials	Carbon in the materials, extraction & manufacture of the materials.
	Transport of materials	Transportation of materials to the construction site.
	Fuel use	GHG emissions from grid electricity use during operation. GHG emissions from fuel consumed by construction vehicles.
	Vessels	GHG emissions arising from the fuel used by vessels transporting workers to the site.
Operations and Maintenance	Vessels	Vessel emissions associated with the Offshore Proposed Development
	Maintenance and repair	Maintenance emissions during the operational stage are likely to be minimal in proportion to the overall proposed development GHG footprint
	Operations	Emissions associated with operational energy consumption
Decommissioning	Transport of materials	Transportation of materials to decommissioning site.
	Fuel use	GHG emissions from grid electricity use during operations. GHG emissions from fuel consumed by deconstruction vehicles.
	Vessels	GHG emissions arising from the fuel used by vessels transporting workers to the site.

The likely electricity generation output arising from the Offshore Proposed Development during operation (based on a common operational profile used across the EIA), will be assessed and contextualised against the forecast marginal carbon intensity of grid electricity for the UK in future years.

Aligning with Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure[16], and Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022) guidance and best practice, a summary of GHG emission sources included within the lifecycle assessment informing this assessment can be found in Table 19.2.

Table 19.2: Summary of GHG study area components within the Climate assessment

Project Stage	PAS 2080 Lifecycle Stage[17]	Description	Justification for Assessment Inclusion/ Exclusion
Pre-construction	A0	Preliminary studies, consultation	Included – emissions associated with vessels required for pre-construction surveys.
Construction	A1-3	Raw material supply	Included.
	A4	Transport to works site	Included.
	A5	Construction/installation processes	Included – emissions associated with plant use and fuel for vehicles/shipping during construction processes.
	D	Land use change	Excluded – offshore components assumed to be negligible.
Operation	B1	Use	Excluded – GHG emissions associated with fabric of products and materials once they have been installed is assumed to be negligible.
	B2, B3, B4	Maintenance, repair and replacement.	Included

[16] PAS 2080 is a standard for managing carbon in building and infrastructure. It looks at the whole value chain and aims to reduce carbon and cost through intelligent design, construction and use.
[17] This approach collates and analyses all materials and activities to be completed within each lifecycle stage to deliver the required infrastructure. (Construction Leadership Council, 2019)

Project Stage	PAS 2080 Lifecycle Stage[17]	Description	Justification for Assessment Inclusion/ Exclusion
	B5	Refurbishment	Excluded – the Offshore Proposed Development is not expected to undergo refurbishment during its lifetime[18]
	B6	Operational energy use	Excluded – GHG emissions associated with energy consumption (e.g., lighting) are likely to be negligible offshore. Any assessment of low carbon electricity generation benefits will be included in this lifecycle stage.
	B7	Operational water use	Excluded – GHG emissions associated with water use on site are likely to be negligible offshore.
	B8	Other operational processes	Excluded – other GHG emissions associated with the Offshore Proposed Development (such as management of operational waste) are likely to be negligible offshore.
	B9	User utilisation of infrastructure	Excluded – not applicable to the Offshore Proposed Development.
	D	Ongoing land use emissions and sequestered	Excluded – offshore components assumed to be negligible.
End of Life	C1	Deconstruction	Included.
	C2	Transport	Included.
	C3	Waste processing for recovery	Included.

[18] At the end of the proposed development's lifetime, there will be an assessment of the viability for re-powering versus decommissioning. If re-powering was deemed feasible, an assessment process would be completed at a later stage (not included as part of the current EIA/application process).

Project Stage	PAS 2080 Lifecycle Stage[17]	Description	Justification for Assessment Inclusion/ Exclusion
	C4	Disposal	Included.

19.2.2 CCR Assessment

The study area for the CCR assessment is based on the permanent and temporary construction footprints within the Offshore Proposed Development (including the Array Areas and OfECC). The assessment includes all potential climate hazards associated with the Offshore Proposed Development and its assets. The assessment for climate effects will be performed across the assumed lifecycle for the Offshore Proposed Development. The climate's direct effects include damage to assets as a result of projected climate change, and the associated costs in terms of loss of time, loss of function, repairs, etc.

Within the study area there are both offshore and coastal elements. The main source of information to identify future changes in climate for the assessment is the UKCP18 Met Office (2018) UK Climate Projections (UKCP). The UKCP are developed to reflect future climate change projections for land and coastal areas, and not specifically for offshore areas. However, for the purposes of a proportionate assessment of climate risk, the baseline and projection data used within the CCR assessment have been taken from the UKCP18 projections for the local area and are assumed to broadly reflect changes in the vicinity of the elements of the Offshore Proposed Development in the offshore area. Some impacts identified via UKCP18 (e.g., flooding) will not be applicable to offshore areas.

19.2.3 ICCI Assessment

The study area for the ICCI assessment is the study area for each EIA topic as described in the relevant technical chapters of this Offshore Scoping Report.

19.3 Baseline Environment

The UK is currently not on track to meet future targets or the overall reduction target ('COP27: Key outcomes and next steps for the UK. December 2022' (Climate Change Committee, 2022)) despite outperforming on the carbon budget set out in the Climate Change Act, 2008. Currently the offshore wind projects in Scotland are a key part in helping Scotland work towards the Just Transition in Net Zero (Scottish Government 2023). Therefore it is important that this Offshore Proposed Development, which will produce up to 2.3 GW of electricity once operational, minimises the release of GHG as much as is feasible and is as carbon neutral as possible.

19.3.1 GHG Assessment

Aligning with IEMA (2022) guidance, the baseline (Do-Minimum (DM) scenario) is the reference against which the impact of the Offshore Proposed Development will be compared and assessed. Assumptions are made on the projected cumulative GHG emissions over the study period under this DM scenario. The DM scenario comprises the cumulative GHG baseline as a continuation of the current situation in the event that the Offshore Proposed Development is not implemented.

There are currently no direct baseline GHG emissions from offshore infrastructure within the boundary of the Project to review. There is one other OWF proposed for development within the NE1 PO area, the Stoura OWF which is being progressed by ESB Asset Development. This OWF has an indicative capacity of up to 500 MW and it is currently unknown what the GHG emissions will be for this project. This project is currently within the pre-planning stage and is not yet consented or built. Therefore, as there are currently minimal activities ongoing on the site, the baseline emissions associated with the Offshore Proposed Development are considered to be negligeable.

19.3.2 CCR Assessment

The baseline for the CCR assessment will be defined using high level climatology observations generated by the Met Office. The Met Office data will be used to understand the current presence and intensity of a full list of climate hazards including temperatures (hot & cold), sunshine, rainfall, and wind averages. The nearest Met Office station to the Offshore Proposed Development is in Lerwick. Historical observations recorded over a 30-year period for Lerwick are presented in Table 19.3.

Table 19.3: Historic Climatic Observations in Lerwick between 1991 and 2020

Climatic Conditions	Climate observations (1991-2020)
Temperature	Mean annual temperatures were around 7.70°C in the area surrounding Lerwick. November to February (winter) maximum daily temperatures ranged from 5.80°C to 8.10°C. The lowest temperatures on average in the winter period were between 1.81°C to 4.31°C. Between June-August (summer) the maximum daily averages were between 12.61°C to 14.70°C. The lowest summer daily averages were between 8.05°C to 10.47°C.
Sunshine	The annual average hours of sunshine were 1157.99.
Rainfall	The annual average amount of rainfall was 1252.34 mm. The number of days it rained in the year on average was 204.13.
Snowfall	Snow lay for approximately 20 days annually.
Wind	The annual average speed of the wind at 10 m is 11.24 knots
Air Frost	Air frost occurs when the temperature at 1.25 m above the ground falls below 0°C. The average of number of days of air frost was 74.13.
Ground Frost	Ground frost refers to a temperature below 0 °C measured on a grass surface. The average of number of days of ground frost was 82 annually.

19.3.3 ICCI Assessment

The baseline for the ICCI Assessment will be the baseline for each topic as described in each technical chapter.

19.4 Embedded Mitigation

The key climate change impacts will be reduced via embedded mitigation measures as part of the initial design process. These embedded mitigation measures are proposed to reduce the potential environmental effects of development. Measures related to climate change are as follows:

- C-4: Development of and adherence to a CMS. The CMS will confirm construction methods and the roles and responsibilities of parties engaged in construction. It will detail any construction-related mitigation measures.
- C-6: Development of and adherence to an EMP. The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: Chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management.
- C-12: Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction Project phases.
- C-14: Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Project.

19.5 Scoping of Impacts

An initial assessment of the likelihood of significant effects on climate receptors and processes due to the Offshore Proposed Development are presented in Table 19.6. The assessment is based on the combination of:

- The current extent of the Offshore Proposed Development;
- Embedded mitigations;
- Known environmental baseline;
- Evidence for climate effects associated with the Offshore Proposed Development;
- Policy and guidance; and
- Professional judgment of qualified climate specialists.

19.5.1 GHG Assessment

The Offshore Proposed Development will generate GHG emissions during construction, however the nature of the Offshore Proposed Development supports the generation of low carbon electricity throughout its operational phase and should present a net benefit when compared to any future baseline if the Offshore Proposed Development is absent (assuming the continued use of fossil fuels and nuclear energy).

The potential sources of GHG emissions during the Offshore Proposed Development lifecycle are outlined in Table 19.4.

Table 19.4: Potential sources of GHG emissions during the Offshore Offshore Proposed Development Lifecycle

Sub-stage of PAS 2080 Lifecycle	Potential Source of GHG Emissions
Construction	
Product stage: including raw material supply, transport and manufacture (A1-3)	Embodied GHG emissions associated with the required raw materials. Vehicle emissions for transportation prior to factory gate. Energy use for fabrication of offshore project elements (e.g., WTGs). Industrial and energy emissions in the manufacture of materials.
Construction process stage: including transport to and from works site as well as construction and installation processes (A4-5)	Vehicle and shipping emissions for transportation of materials to site. Energy and fuel use in construction processes.
Operation	
Operation and maintenance (including repair and replacement) (B2-B5)	Energy consumption for infrastructure operation and activities of organisations conducting routine maintenance including extraction, manufacture, transportation, and installation energy use. Embodied carbon associated with materials used for repair and replacement activities.
End-Of-Life	
Decommissioning (C1-4)	Energy consumption in deconstruction process. Vehicle and shipping emissions for transportation of materials away from site. Waste management of decommissioning materials.

19.5.2 CCR Assessment

During the construction phase (currently assumed as late 2020's to early 2030's) and the operational phase (anticipated from the early 2030's) of the Offshore Proposed Development, there is potential for anticipated changes to the climate (including extreme weather events such as storm damage to structures and assets) to negatively impact the Offshore Proposed Development. These include the potential extreme weather events and climate changes displayed in Table 19.5.

Table 19.5: Extreme Weather Events and Changes in Climate that may effect the Offshore Proposed Development

Weather event	Potential impacts
Heavy Rain	• Delay to construction programme.

Weather event	Potential impacts
	• Damage to WTG blades in use, such as leading-edge erosion.
High Winds	• Damage to WTGs/rotor blades from wind/wind borne debris in use; • Uneven loading of WTGs; • Delay to construction program.
High temperatures for prolonged periods	• Health impacts of workers from breathing problems and Sunstroke; • Heat stress on electronic equipment; • Increased frequency of maintenance and repair/replacement.
Extreme weather events	• Increased requirement for maintenance and repair • Increased costs (e.g., associated with increased frequency of maintenance and repair) • Uneven loading of WTGs • Damage to WTGs/rotor blades from hail/wind/wind borne debris in use.
Snow and Ice	• Uneven loading of WTGs (ice build up); • Damage to WTG blades; • Diminished energy production; • Health impacts from cold weather.
Fog	• Danger to workers/shipping due to reduced visibility
Lightning	• Structural damage, and fires on infrastructure; • Power surges and tripping electrical breakers • Health impacts from direct strikes Impacts can cause secondary GHG emissions through the necessary maintenance activities (Vessels, loss of low carbon energy etc.)

19.5.3 Potential Impacts Scoped In

Table 19.6 below identifies those potential impacts scoped into EIA. No scoping out of potential impacts has been identified.

Table 19.6: Impacts scoped into the assessment of Climate Change

Impact	Description	Proposed Assessment Approach	Embedded mitigation
Construction			
GHG emissions associated with construction materials (raw material supply, transportation, and manufacture)	The Offshore Proposed Development will lead to generation of GHG emissions during construction in relation to the construction materials.	GHG Assessment	C-4 (CMS); C-6 (EMP); C-12 (PEMP)
GHG emissions associated with construction processes including transportation to site and installation processes.	The Offshore Proposed Development will lead to generation of GHG emissions during construction/installation.	GHG Assessment	C-4 (CMS); C-6 (EMP); C-12 (PEMP)
CCR of construction period	There is potential for anticipated changes to climate (such as extreme weather events) to negatively impact the Offshore Proposed Development during construction and decommissioning.	CCR Assessment	C-4 (CMS); C-6 (EMP); C-12 (PEMP); C-14 (DP)
ICCI of construction period	The Offshore Proposed Development has potential to be negatively impacted by significant climate change effects during construction and decommissioning.	ICCI Assessment	C-4 (CMS); C-6 (EMP); C-12 (PEMP); C-14 (DP)
Operation and maintenance			

Impact	Description	Proposed Assessment Approach	Embedded mitigation
GHG emissions associated with operation including energy use	The generation of low carbon electricity during the O&M phase will be supported by the Offshore Proposed Development, but the net benefits against a future baseline will be assessed.	GHG Assessment	C-6 (EMP); C-12 (PEMP)
GHG emissions that are associated with maintenance including materials used for repair and replacement activities	The Offshore Proposed Development will lead to generation of GHG emissions during maintenance activities associated with material replacement and repair activities.	GHG Assessment	C-6 (EMP); C-12 (PEMP)
CCR of operations period	Changes of climate that are anticipated (like extreme weather events) may negatively impact the Offshore Proposed Development during O&M.	CCR Assessment	C-6 (EMP); C-12 (PEMP)
ICCI of operations period	The Offshore Proposed Development has potential to be negatively impacted.	ICCI Assessment	C-6 (EMP); C-12 (PEMP)
Decommissioning			
GHG emissions associated with decommissioning processes including transportation	The Offshore Proposed Development will lead to generation of GHG emissions during decommissioning.	GHG Assessment	C-6 (EMP); C-14 (DP)
CCR of construction and decommissioning period	There is potential for anticipated changes to climate (such as extreme weather events) to negatively impact the Offshore Proposed	CCR Assessment	C-4 (CMS); C-6 (EMP); C-12 (PEMP); C-14 (DP)

Impact	Description	Proposed Assessment Approach	Embedded mitigation
	Development during construction and decommissioning.		
ICCI of construction and decommissioning period	The Offshore Proposed Development has potential to be negatively impacted by significant climate change effects during construction and decommissioning.	ICCI Assessment	C-4 (CMS); C-6 (EMP); C-12 (PEMP); C-14 (DP).

19.6 Potential Cumulative Impacts

The process by which potential cumulative impacts will be assessed through the CIA is described in Chapter 4: EIA Methodology. For Climate, cumulative interactions may occur with other infrastructure in the area such as the proposed Stoura OWF; subsea pipelines, INTOG developments and cables.

The CIA for Climate will consider the maximum design scenario for each of the projects, plans and activities in the vicinity of the Offshore Proposed Development in line with the methodology outlined in Chapter 4: EIA Methodology and relevant guidance.

In line with the IEMA GHG guidance (2022) cumulative impacts will be scoped out for the GHG Assessment.

Within the CCR assessment, cumulative impacts would be present where other offshore infrastructure would increase climate risks to the Offshore Proposed Development. Due to the nature of offshore infrastructure in the vicinity, it is not deemed likely that other developments would add to climate risks. Therefore, these are scoped out of the climate assessment.

Within the ICCI assessment, cumulative impacts would arise where climate change impacts environmental receptors which are themselves at risk from cumulative impacts. It is expected these cases are likely to be minimal but risks of ICCI cumulative impacts will be scoped into the main review of ICCI risks.

19.7 Potential Transboundary Impacts

The process by which potential transboundary impacts will be assessed is described in Chapter 4: EIA Methodology.

The following transboundary impacts have been identified as potentially resulting from activities associated with the Offshore Proposed Developments construction, O&M, and decommissioning stages:

GHG emissions are typically transboundary and will be continuously assessed against national carbon targets, which represent the international consensus on reducing global GHG concentrations, according to the COP27 agreement.

The Offshore Proposed Development is a significant distance from the nearest adjacent EEZ of another state and, therefore, it is considered that significant transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

For the CCR and ICCI assessments, there is not a likely potential that there will be significant transboundary impacts, and these are therefore scoped out of the assessment.

19.8 Proposed Approach to EIA

19.8.1 Relevant Guidance

In addition to the general approach and guidance outlined in Chapter 4: EIA Methodology, the assessment of Climate receptors will also comply with the following guidance documents where they are specific to this topic:

- UKCP18 (UK Climate Projection data base office, 2018) - Climate resilience assessment
- Inventory of Carbon and Energy Database (2024) - Obtain emission factors for the GHG assessment.
- Climate Change Act (2008) - Help to reach the six carbon budgets;
- BEIS (2023)- Data for GHG emissions;
- IEMA (2020): EIA Guide to Climate Change Resilience and Adaptation.
- IEMA (2022): EIA Guide to Assessing GHG Emissions and Evaluating their Significance.

19.8.2 Anticipated Additional Data Sources at EIA

A more detailed literature review will be developed for the EIA, building upon the high-level outline provided in Section 19.3 of this chapter. The information to inform this carbon assessment will be from a combination of project specific information available at the current design stage alongside publicly available industry benchmarks that can be used to provide a preliminary estimate of embodied carbon emissions and operational energy. Data sources will likely include:

- Project-specific information available on design at the EIA stage;
- Project-specific survey outputs, from the planned Metocean Survey campaign;
- Publicly available industry benchmarks that will be used to inform a preliminary estimate of the embodied carbon emissions and operational energy;
- Manufacturer handbooks on equipment/machinery emission outputs (specific to the proposed WTG technology); and
- ISO 14040 Series for Standard for Life Cycle Assessment

19.8.2.1 GHG Assessment

The information to inform the GHG assessment will be from a combination of publicly available industry benchmarks that can be used to provide a preliminary estimate of embodied carbon emissions and operational energy and project specific information available at the current design stage.

The main emissions factors used in the assessment will be from the following sources:

- Greenhouse Gas Reporting: Conversion Factors (published annually);
- Inventory of Carbon and Energy database (Circular Ecology 2024); and
- Valuation of energy use and greenhouse gas emissions for appraisal: supplementary guidance to the HM Treasury Green Book (HM Government 2012).

The carbon emissions for the Offshore Proposed Development will be calculated by converting 'activity' data into carbon emissions through the application of referenced typical emissions conversion factors widely used within the industry.

The main reference periods for assessing emissions will be in line with the UK Carbon Budget periods, covering 2025-2037 (Fourth, Fifth and Sixth Carbon Budgets), summarised in Table 19.7.

Table 19.7: Carbon budget periods

Carbon Budget and Period	Carbon Budget Limit	Reduction below 1990 levels
Fourth (2023-2027)	1,950 $MtCO_2e$	52% by 2025

Fifth (2028-2032)	1,725 MtCO2e	58% by 2030*
Sixth (2033-3037)	969 $MtCO_2e$	77% by 2035

* Originally 57% when Fifth Carbon Budget was enshrined in law, has recently been increased to 68% as the UK's National Determined Contribution ahead of the United Nations' Conference of the Parties (COP26) in November 2021 (BEIS, 2020).

19.8.2.2 CCR Assessment

Within the CCR Assessment, the future projected climate conditions and extreme weather events for the area in the vicinity of the Offshore Proposed Development will be provided up to the 2070s. This will cover the time period for the assumed operational lifetime for the Offshore Proposed Development.

For the historical baseline data, the changes in average climate conditions will be taken from the Met office UKCP18 probabilistic projections (Met Office 2018) of climate change to establish the future climate baseline.

In the Offshore EIAR, the climate change projections for a range of meteorological parameters will be presented for different probability levels within the RCP8.5 high emission scenario for the near-term and long-term future time periods for the 2070s.

19.8.3 Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4: EIA Methodology of this Offshore Scoping Report and will be supported by a desk-based review of available information to determine current baseline conditions. The main desk-based sources of information that have been reviewed to inform the current baseline description within the vicinity of the Offshore Proposed Development include the data sources displayed in section 19.8.2.

19.8.3.1 GHG Assessment

In selecting or developing an approach for project EIA GHG emissions assessment, the aim should be to deliver a robust, appropriate and consistent assessment. The carbon assessment will therefore be consistent with the best practice approach set out in the IEMA guidance on assessing GHG emissions and evaluating their significance (IEMA 2022).

The GHG assessment will calculate and report the GHG emissions anticipated to be generated or prevented by the Offshore Proposed Development during its lifecycle. This will be reported in tonnes of carbon dioxide equivalent (tCO2e), a single metric of the global warming potential of the main GHGs.

Quantification of the GHG emissions for the Offshore Proposed Development will be undertaken. The quantification calculation formula for determining a GHG emission (or removal value), associated with the works, will have the following structure:

GHG emission factor × Activity data = GHG emission or removal

The methodology focuses on assessing the impact of the Offshore Proposed Development on carbon emissions by quantifying the net carbon emissions arising from each lifecycle stage. Emissions associated with the Offshore Proposed Development will be compared to the baseline DM scenario (as described under section 19.3 Baseline Environment) to quantify the net impact of the Offshore Proposed Development.

19.8.3.2 CCR Assessment

The CCR assessment will adhere to IEMA's climate change resilience and adaptation guide (IEMA, 2020). The current and future baseline will be established using historical climate records and climate projections as detailed above in Table 19.3 and section 19.8.2.2. The CCR assessment relates to the resilience of the Offshore Proposed Development to the impacts of climate change. Potential hazards to the Offshore Proposed Development will be addressed in the CCR assessment, which will present results from the lifecycle phases of the Offshore Proposed Development.

The CCR assessment is a risk assessment-based methodology for identifying potential climate impacts and assessing their severity. Extreme weather events, sea level rises and storm surges are key impacts related to climate change that will be taken into consideration during construction and operation of the Offshore Proposed Development. The CCR assessment will be qualitative and will identify future climate hazards and consider the potential impacts and risks arising from these hazards on to the Offshore Proposed Development.

There are five levels that risks can be scored:

- Very high;
- High;
- Medium;
- Low; and
- Very low

Carrying out the risk assessment can be summarised into the following steps:

- Identifying potential climate change risks to a scheme or project;
- Assessing these risks (potentially prioritising to identify the most severe); and
- Formulating mitigation actions to reduce the impact of the identified risks.

The sensitivity of receptors concerning potential climate change impacts will be determined by their susceptibility and vulnerability, reflecting their capacity to be affected by change and their level of exposure, respectively. The magnitude of a climate change impact will be assessed based on the combination of likelihood and consequence. Likelihood pertains to the probability of the impact occurring over a relevant time frame, while consequence refers to the nature and severity of harm to the relevant receptor (IEMA, 2020).

The assessment of the likely significant environmental effects will be undertaken under the existing climate baseline using standard methodologies for each relevant environmental topic being assessed as part of the EIA and reported within the EIAR.

Due to the absence of established significance criteria for the CCR assessment, the determination of whether an effect is significant will rely on consideration of the project context and expert judgment (IEMA, 2020).

19.8.3.3 ICCI assessment

Following the consideration of climate change impacts environmental discipline experts will use professional judgement to produce high level, qualitative statements about potential topic specific impacts resulting from projected climate change (i.e. changes and trends in climate averages and extreme weather events) for receptors and resources in the area surrounding the Offshore Proposed Development. This includes the recommendation for required mitigation measures and allowances for future monitoring. This will ensure that the detection of unexpected impacts on environmental receptors and resources is carried out.

The potential significance of in-combination climate change impacts will be assessed qualitatively (where required), based upon the professional judgement of relevant environment and climate change specialists.

All EIAR topics may be affected by climate change impacts therefore, the Offshore Proposed Development will be designed to be resilient to forecast changes in climate and the in-combination impacts will be evaluated for all topics.

19.9 Scoping Questions

The following scoping questions refer to the climate change and greenhouse gas chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the use of those data listed in Section 19.3, and any additional anticipated data listed in Section 19.8, being used to inform the Offshore EIA?
- Do you agree that all receptors related to Climate change have been identified?
- Do you agree with the scoping in and out of impacts related to Climate change?
- Do you agree with the proposed approach to the assessment of transboundary effects related to Climate change?
- Do you agree with the scoping in and out of transboundary impacts related to Climate change?
- Do you agree with the proposed approach to the assessment of cumulative effects related to Climate change?
- Do you agree with the proposed study areas identified for the Climate change receptors?
- Do you agree with the proposed assessment methodology related to Climate change?
- Do you agree with the suitability of the embedded mitigation measures we have considered and proposed for inclusion?

20 Summary of Offshore EIA Scoping

This Offshore Scoping Report provides details of the Offshore Proposed Development, along with an overview of the baseline environmental information currently available. The report summarises relevant legislation and policy, outlines the proposed EIA methodology, sets out potential impacts and identifies those that may arise as significant as a result of the Offshore Proposed Development and describes how these impacts are proposed to be assessed. Within this Offshore Scoping Report, each technical chapter proposes studies and surveys to inform the EIA process and sets out embedded mitigation measures to be taken forward into the EIA.

20.1 Impacts and Commitments

Each technical chapter in this Offshore Scoping Report has identified a number of potential impacts that may arise due to the construction, O&M and decommissioning of the Offshore Proposed Development and will, therefore, be scoped into the Offshore EIAR. The potential impacts that may occur during the lifecycle of the Offshore Proposed Development are compiled in the Impacts Register (Appendix B). The Impact Register captures all of the potential impacts that have been scoped in for further consideration as part of the EIA. The Impacts Register will be treated as a 'live' document and will be submitted alongside the Offshore Application supporting the EIAR. The impacts that may be identified as a result of the forthcoming Scoping Opinion and/or following consultation during the pre-application stage will be included in the Impacts Register.

Within this Offshore Scoping Report, each technical chapter has taken into account embedded commitments that will be committed to as part of the project design process. Appendix A sets out the embedded commitments and details the technical topic that these are relevant to. This Commitments Register will be treated as a 'live' document, which will be updated and developed further as the EIA progresses and in response to feedback from stakeholder consultation.

As a result of the commitment to implement these measures, and to align the Offshore Proposed Development with standard sectoral practices and procedures, the embedded commitments are inherently part of the design of the Offshore Proposed Development and are included in the assessment presented in each of the technical chapters.

20.2 Topics Scoped into the Offshore EIA

The list of environmental topics that will be scoped into the Offshore EIA and EIAR for the Offshore Proposed Development are as follows:

- Marine Geology, Oceanography and Physical Processes (Chapter 6);
- Marine Water and Sediment Quality (Chapter 7);
- Benthic and Intertidal Ecology (Chapter 8);
- Fish Ecology (Chapter 9);
- Marine Mammal Ecology (Chapter 10);
- Offshore Ornithology (Chapter 11);
- SLVIA (Chapter 12);
- Commercial Fisheries (Chapter 13);

- Aviation and Radar (Chapter 14);
- Shipping and Navigation (Chapter 15);
- Offshore Archaeology and Cultural Heritage (Chapter 16);
- Other Marine Users and Infrastructure (Chapter 17);
- Socioeconomics, Tourism and Recreation (Chapter 18); and
- Climate Change and Greenhouse Gas (Chapter 19).

20.3 Topics Scoped out of the Offshore EIA

Full details for Offshore EIA topics scoped in and out of the EIA are summarised in Appendix B (Impacts Pathway Register). The following list of topics have been scoped out of the EIAR for the Offshore Proposed Development EIAR:

- Offshore Airborne Noise and Vibration;
- Offshore Air Quality;
- Major Accidents and Disasters; and
- Human Health.

The list of topics that will be considered further in the EIA Process and included within the EIAR for the Offshore Proposed Development will be confirmed after the publication of the Scoping Opinion and after consultation with statutory stakeholders and consultees.

20.4 Next Steps

The next steps are summarised in Table 20.1 below, and include programmed timeframes:

Table 20.1: Future stages of the Application

Next Stage	Indicative Timeframe
Receipt of Scoping Opinion	Summer 2024.
Pre-application Consultation	Ongoing from receiving receipt of Scoping Opinion to submitting application in summer 2026. Inclusive of re-validation of Scoping Opinion, if required.
Submission of EIAR	Summer 2026.

References

Chapter 1 to 5

British Standards Institution (2015), 'Environmental impact assessment for offshore renewable energy projects'. https://knowledge.bsigroup.com/products/environmental-impact-assessment-for-offshore-renewable-energy-projects-guide/standard/preview [Accessed: October 2023].

Cefas (2004), 'Offshore Wind Farms: Guidance Note for EIA in Respect of Food and Environmental protection Act (FEPA) and Coast Protection Act (CPA) Requirements: Version 2'. https://www.cefas.co.uk/publications/files/windfarm-guidance.pdf [Accessed: October 2023].

Cefas (2012), 'Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects'. https://tethys.pnnl.gov/sites/default/files/publications/CEFAS_2012_Eenvironmental_Assessment_Guidance.pdf [Accessed: October 2023].

CIEEM (2018), 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine'. https://cieem.net/wp-content/uploads/2019/02/Combined-EclA-guidelines-2018-compressed.pdf [Accessed: October 2023].

Crown Estate Scotland (2023), 'ScotWind Leasing Round' https://www.crownestatescotland.com/scotlands-property/offshore-wind/scotwind-leasing-round [Accessed January 2024].

ESO, 2024. Beyond 2030 A national blueprint for a decarbonised electricity system in Great Britain. Available at: https://www.nationalgrideso.com/document/315516/download [Accessed April 2024].

European Commission (1999), 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions'. https://wayback.archive-it.org/12090/20151221014945/http:/ec.europa.eu/environment/archives/eia/eia-studies-and-reports/pdf/guidel.pdf [Accessed: October 2023].

European Commission (2001), 'Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC. https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf [Accessed: October 2023].

European Commission (2017), 'Environmental Impact Assessment for Projects: Guidance on the preparation of the Environmental Impact Assessment Report'. https://circabc.europa.eu/ui/group/3b48eff1-b955-423f-9086-0d85ad1c5879/library/b7451988-d869-4fee-80de-0935695f67f2/details?download=true [Accessed: October 2023].

Highways England (2019), 'Design Manual for Roads and Bridges index Version 1.0.0; Publication: October 2023' [online]. Available at: https://www.standardsforhighways.co.uk/search/html/f670746e-788f-4687-9272-6cea23ba9901?standard=DMRB

HM Government (1997), 'Town and Country Planning (Scotland) Act 1997'. https://www.legislation.gov.uk/ukpga/1997/8/contents [Accessed: October 2023].

HM Government (2004), 'Energy Act 2004: Part 2 Sustainability and Renewable Energy Sources'. https://www.legislation.gov.uk/ukpga/2004/20/part/2 [Accessed: October 2023].

HM Government (2011), 'UK Marine Policy Statement'. https://www.gov.uk/government/publications/uk-marine-policy-statement [Accessed: October 2023].

HM Government (2013), 'UK Renewable Energy Roadmap: 2013 update'. https://www.gov.uk/government/publications/uk-renewable-energy-roadmap-second-update [Accessed: June 2023].

HM Government (2017), 'The Clean Growth Strategy: Leading the way to a low carbon future'. https://www.gov.uk/government/publications/clean-growth-strategy [Accessed: October 2023].

HM Government (2021), ' UK Net zero Strategy: Build Back Greener'. https://www.gov.uk/government/publications/net-zero-strategy [Accessed February 2024].

HM Government (2021), 'Energy white paper: Powering our net zero future'. https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future [Accessed February 2024].

HM Government (2022), 'British energy security strategy'. https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy [Accessed: October 2023].

HM Government (2023), 'National Policy Statements for energy infrastructure'. https://www.gov.uk/government/collections/national-policy-statements-for-energy-infrastructure [Accessed February 2024].

Institute of Environmental Management and Assessment (IEMA) (2015), 'Environmental Impact Assessment Guide to Delivering Quality Development'. https://www.iema.net/download-document/7014 [Accessed: October 2023].

Institute of Environmental Management Assessment (IEMA) (2017), 'Delivering Proportionate EIA: A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice'. https://www.iema.net/resources/reading-room/2017/07/18/delivering-proportionate-eia [Accessed: October 2023].

International Association for Public Participation (2024), 'The 3 Pillars of Public Participation'. https://www.iap2.org/general/custom.asp?page=pillars [Accessed February 2024].

Marine Scotland (2018), 'Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications'. https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/govscot%3Adocument/Guidance%2BManual%2Bfor%2BOffshore%2BWind%252C%2BWave%2Band%2BTidal%2BEnergy%2BApplication.pdf [Accessed: October 2023].

Marine Scotland (2022), 'Guidance Notes for the Decommissioning of OREI in Scottish Waters or in the Scottish part of the Renewable Energy Zone under the Energy Act 2004'. https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2022/08/offshore-renewable-energy-decommissioning-guidance-scottish-waters/documents/decommissioning-offshore-renewable-energy-installations-scottish-waters-scottish-part-

renewable-energy-zone-under-energy-act-2004-guidance-notes-industry-scotland/decommissioning-offshore-renewable-energy-installations-scottish-waters-scottish-part-renewable-energy-zone-under-energy-act-2004-guidance-notes-industry-scotland/govscot%3Adocument/decommissioning-offshore-renewable-energy-installations-scottish-waters-scottish-part-renewable-energy-zone-under-energy-act-2004-guidance-notes-industry-scotland.pdf [Accessed January 2024].

OSPAR Commission (2009), 'Assessment of the environmental impacts of cables'. https://qsr2010.ospar.org/media/assessments/p00437_Cables.pdf [Accessed: October 2023].

Planning aid for Scotland (2011), 'Scotland's Scottish Planning = Eff ective Engagement and Delivery (SP=EED)'. https://dtascommunityownership.org.uk/sites/default/files/Scottish%20Planning%20%3D%20Effective%20Engagement%20and%20Delivery%20-%20Practical%20Guide%20to%20Engagement%20in%20Planning_0.pdf#:~:text=SP%3DEEDTM%20stands%20for%20Scottish%20Planning%20%3D%20Eff%20ective,design%2C%20deliver%20and%20assess%20the%20process%20of%20engagement. [Accessed February 2024]

PINS (2019), 'Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects.' Published August 2019 (version 2) [online]. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-17/

Renewables UK (2002), 'Best Practice Guidelines - Offshore Wind Energy Development'.

RenewableUK (2013), 'Cumulative Impact Assessment Guidelines: Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms'. https://tethys.pnnl.gov/sites/default/files/publications/Cumulative-Impact-Assessment-Guidelines.pdf [Accessed: October 2023].

Scottish Community Development Centre (2020a), 'National Standards for Community Engagement'. https://www.scdc.org.uk/what/national-standards/ [Accessed February 2024].

Scottish Community Development Centre (2020b), 'National Standards for Community Engagement: Engaging with our communities to support recovery and renewal'. https://static1.squarespace.com/static/60b74b3ad7fb3972cfe271b0/t/61409e86f20b94259a7c7656/1631624839455/NSfCE+Report_Final2.pdf [Accessed February 2024].

Scottish Government (2009), 'Climate Change (Scotland) Act 2009'. https://www.legislation.gov.uk/asp/2009/12/contents [Accessed: October 2023].

Scottish Government (2010), 'Planning Advice Note 3/2010: community engagement'. https://www.gov.scot/publications/planning-advice-note-3-2010-community-engagement/ [Accessed February 2024].

Scottish Government (2011), 'Blue Seas Green Energy. A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters. March 2011'. https://webarchive.nrscotland.gov.uk/3000/https://www.gov.scot/Publications/2011/03/18141232/8 [Accessed: October 2023].

Scottish Government (2013a), '2020 Challenge for Scotland's Biodiversity'. https://www.gov.scot/publications/2020-challenge-scotlands-biodiversity-strategy-conservation-enhancement-biodiversity-scotland/ [Accessed February 2024].

Scottish Government (2013b), 'Scottish Electricity Generation Policy Statement – 2013'. https://www.gov.scot/publications/electricity-generation-policy-statement-2013/documents/ [Accessed: October 2023].

Scottish Government (2015a), 'Scotland's National Marine Plan: A Single Framework for Managing Our Seas'. https://www.gov.scot/publications/scotlands-national-marine-plan/documents/ [Accessed: October 2023].

Scottish Government (2015b), 'Scottish Marine Regions Order 2015'. https://www.legislation.gov.uk/ssi/2015/193/article/1/made [Accessed: October 2023].

Scottish Government (2017), 'Scottish Energy Strategy: The future of energy in Scotland'. https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-paper/2017/01/scottish-energy-strategy-future-energy-scotland/documents/00513466-pdf/00513466-pdf/govscot%3Adocument/00513466.pdf [Accessed: October 2023].

Scottish Government (2018), 'Climate Change Plan: third report on proposals and policies 2018-2032 (RPP3)'. https://www.gov.scot/publications/scottish-governments-climate-change-plan-third-report-proposals-policies-2018/documents/ [Accessed: October 2023].

Scottish Government (2019a), 'Climate Change (Emissions Reduction Targets) (Scotland) Act 2019'. https://www.legislation.gov.uk/asp/2019/15/enacted [Accessed: October 2023].

Scottish Government (2019b), 'Scottish Government's Consultation Good Practice Guidance'. https://www.gov.scot/binaries/content/documents/govscot/publications/foi-eir-release/2019/12/foi-201900009119/documents/foi-201900009119---information-released/foi-201900009119---information-released/govscot%3Adocument/FOI-201900009119%2B-%2BInformation%2BReleased.pdf [Accessed February 2024].

Scottish Government (2020a), 'Sectoral Marine Plan for Offshore Wind Energy'. https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/documents/ [Accessed: October 2023].

Scottish Government (2020b), 'Offshore Wind Policy Statement'. https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/10/offshore-wind-policy-statement/documents/offshore-wind-policy-statement/offshore-wind-policy-statement/govscot%3Adocument/offshore-wind-policy-statement.pdf [Accessed: October 2023].

Scottish Government (2020c), 'Guidance on Marine Licensable Activities subject to Pre-Application Consultation'. https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/guidance-on-activities-subject-to-pre-application-consultation/guidance-on-activities-subject-to-pre-application-consultation/govscot%3Adocument/Guidance%2Bon%2Bactivities%2Bsubject%2Bto%2Bpre-application%2Bconsultation.pdf#:~:text=Sections%2022%2C%2023%20and%2024%20of%20the%20Marine,Regulations%202013%2C%20set%20out%20what%20that%20process%20entails. [Accessed: October 2023].

Scottish Government (2022a), 'Initial Plan Framework Sectoral Marine Plan for Offshore Wind for Innovative and Targeted Oil and Gas Decarbonisation (INTOG). February 2022'. https://www.gov.scot/publications/initial-plan-framework-sectoral-marine-plan-offshore-wind-innovation-targeted-oil-gas-decarbonisation-intog [Accessed: October 2023].

Scottish Government (2022b), 'The Scottish Biodiversity Strategy to 2045: Tackling the Nature Emergency in Scotland'. https://www.gov.scot/publications/scottish-biodiversity-strategy-2045-tackling-nature-emergency-scotland/documents/ [Accessed: October 2023].

Scottish Government (2023a), 'Draft Energy Strategy and Just Transition Plan – Delivering a Fair and Secure Zero Carbon Energy System for Scotland. January 2023'. https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/01/draft-energy-strategy-transition-plan/documents/draft-energy-strategy-transition-plan/draft-energy-strategy-transition-plan/govscot%3Adocument/draft-energy-strategy-transition-plan.pdf [Accessed: October 2023].

Scottish Government (2023b), 'National Planning Framework 4'. https://www.gov.scot/publications/national-planning-framework-4/documents/ [Accessed: October 2023].

Scottish Government (2023c), 'Marine licensing – exempted activities: guidance'. https://www.gov.scot/publications/marine-licensing-exempted-activities-guidance/ [Accessed: October 2023].

Scottish Government (2023d), 'The Scottish Government Strategy for Marine Nature Conservation'. https://www.gov.scot/policies/marine-environment/conservation/ [Accessed February 2024].

Scottish Government (2023e), 'Effective community engagement in local development planning guidance: consultation'. https://www.gov.scot/publications/effective-community-engagement-local-development-planning-guidance-consultation/ [Accessed February 2024].

Scottish Natural Heritage (SNH) (2018), 'A Handbook on Environmental Impact Assessment'. https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf [Accessed: October 2023].

Shetland Islands Council (2014), '2014 Shetland Local Development Plan'. September 2014. https://www.shetland.gov.uk/downloads/file/1930/local-development-plan-2014 [Accessed March 2024].

Shetland Islands Council (2015), 'Supplementary Guidance. Shetland Islands' Marine Spatial Plan' Fourth Edition, 2015. https://www.shetland.gov.uk/downloads/file/1948/shetland-islands-marine-spatial-plan-adopted-february-2015- [Accessed March 2024].

Shetland Islands Council (2022), 'Shetland Energy Development Principles'. https://www.shetland.gov.uk/climate-change-3/shetland-energy-development-principles [Accessed November 2023].

United Nations (2015), 'Paris Agreement'. 233http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf [Accessed: October 2023].

Chapter 6 - Marine Geology, Oceanography and Physical Process

ABPmer (2018), 'SEASTATES Metocean Data and Statistics Interactive Map'. Available from:www.seastates.net [Accessed: October 2023].

ABPmer (2011), 'Burbo Bank Outstanding Licensing Conditions' R.1690

ABPmer and METOC (2002), 'Potential effects of offshore wind developments on coastal processes'.

ABPmer, Cefas and HR Wallingford (2007), 'Review of Round 1 Sediment process monitoring data - lessons learnt (Sed01)'.

ABPmer, HR Wallingford & Cefas (2010), 'Further review of sediment monitoring data (COWRIE ScourSed-09)'.

ABPmer, Met Office and POL (2008), 'Atlas of UK Marine Renewable Energy Resources: Atlas Pages. A Strategic Environmental Assessment Report, March 2008'. BP Marine Environmental Research Ltd. Produced for BERR Available from:https://www.renewables-atlas.info/ [Accessed: October 2023].

ABPmer, Met Office and SeaRoc UK Ltd. (2008), 'Guidelines in the use of metocean data through the lifecycle of a marine renewables development'.

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., & Davidson, N.C. (eds.) (1996), 'Coasts and seas of the United Kingdom. Region 1 Shetland (Shetland: Joint Nature Conservation Committee (Coastal Directories Series)).

BGS (2020), 'GeoIndex Offshore', Available from: https://www.bgs.ac.uk/map-viewers/geoindex-offshore/ [Accessed: October 2023].

British Standards Institution (BSI) (2015), 'Environmental impact assessment for offshore renewable energy projects', Standard number PD 6900:2015.

Brooks. A., Whitehead. P. and Lambkin. D. (2018), 'Guidance on Best Practice for Marine and Coastal Physical Processes Baseline Survey and Monitoring Requirements to Inform EIA of Major Development Projects'. Available from: https://cdn.naturalresources.wales/media/689057/guidance-on-best-practice-for-marineand-coastal-physical-processes-baseline-survey-and-monitoring-requirements-to-informeia-of-major-developement-projects.pdf [Accessed: October 2023].

BERR (2008), 'Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry', Department for Business Enterprise and Regulatory Reform in association with Defra.

Bricheno, L.M and Wolf, J., (2018), 'Future Wave Conditions of Europe, in Response to High-End Climate Change Scenarios'. Journal of Geophys. Res. Ocean. 2018, 123, 8762 to 8791.

Bonaduce, A., Staneva, J., Behrens, A., Bidlot J-R., Wilcke, R.A.I., (2019), 'Wave climate change in the North Sea and Baltic Sea'. Journal of Marine Science and Engineering.

Cefas (2004), 'Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of Food and Environment Protection Act 1985 and Coastal Protection Act 1949 requirements – Version 2 - June 2004', Prepared by Cefas on behalf of the Marine Consents and Environment Unit (MCEU).

Cefas (2011), 'Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy project's', Report reference: ME5403 – Module 15.

Cefas (2016), 'Sediment Climatologies around the UK', Report for the UK Department for Business. Energy & Industrial Strategy offshore energy Strategic Environmental Assessment programme.

Cefas WaveNet (2024), 'Cefas WaveNet Map'. Available at: https://wavenet.cefas.co.uk/map [Accessed: 19 January 2024].

Centre of Expertise for Waters (2021), 'Dynamics Coast: Scotland's Coastal Change Assessment'. Available from:https://www.dynamiccoast.com/ [Accessed: October 2023].

Connor, D.W. (2006), 'UKSeaMap: the mapping of seabed and water column features of UK seas. Joint Nature Conservation Committee'.

Department for Business, Energy and Industrial Strategy (BEIS) (2022a), 'Environmental Baseline Appendix 1b: Geology, Substrates & Coastal Processes. UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4)'. Available from:https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-4-oesea4 [Accessed: October 2023].

Department for Business, Energy and Industrial Strategy (BEIS) (2022b), 'Environmental Baseline Appendix 1d: Water Environment. UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4)'. Available from:https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-4-oesea4 [Accessed: October 2023].

Department for Energy and Climate Change (DECC) (2004), 'Environmental Report Section 5: Physical & Chemical Environment', Strategic Environmental Assessment – SEA5 – Offshore Oil and Gas Licensing.

Dorrell, R, Lloyd, C, Lincoln, B, Rippeth, T, Taylor, J, Caulfield, C., C, Sharples, J, Polton, J, Scannell, B, Greaves, D, Hall, R and Simpson, J. (2022), 'Anthropogenic Mixing of Seasonally Stratified Shelf Seas by Offshore Wind Farm Infrastructure', Frontiers in Marine Science, 9: 830927.

European Marine Observation and Data Network (EMODnet) (2020), 'European Marine Observation and Data Network (EMODnet) Bathymetry'. Available from:https://emodnet.ec.europa.eu/geoviewer/ [Accessed: October 2023].

Farr, H., Ruttenberg, B., Walter, R.K., Wang, Y., and White, C. (2021), 'Potential environmental effects of deepwater floating offshore wind energy facilities'. Ocean and Coastal Management, 207.

Flather, R.A (1987), 'Estimates of extreme conditions of tide and surge using a numerical model of the north-west European continental shelf', Estuarine, Coastal and Shelf Science. 69-93

Flinn, D., Stone, P. and Stephenson, D. (2013), 'The Dalradian Rocks of the Shetland Islands, Scotland', Proceedings of the Geologists' Association, 124(1–2), pp. 393–409. doi:10.1016/j.pgeola.2012.07.007.

Folk, R.L. (1954), 'The Distinction between Grain Size and Mineral Composition in Sedimentary-Rock Nomenclature', Journal of Geology, 62: 344-359.

Fugro-Emu (2014), 'Review of environmental data associated with post-consent monitoring of license conditions of offshore wind farms', MMO Project No: 1031.

Hansom, J.D. (2002), 'The Ayres of Swinister, Shetland [HU 448 723]'. In: Gordon, J.E. and Leys, K.F. (eds.) The Geomorphology of the Scottish Coastline. Geological Conservation Review Series, No. 28. Joint Nature Conservation Committee, Peterborough. Available at: https://gcrseries.scottishgeologytrust.org/gcr28/gcr28_theayresofswinister.html [Accessed: 17 January 2024].

Holmes, R., Bulat, J., Henni, P., Holt, J., James, C., Kenyon, N., Leslie, A., Long, D., Musson, R., Pearson, S., Stewart, H. (2004), 'DTI Strategic Environmental Assessment Area 5 (SEA5): Seabed and superficial geology and processes', British Geological Survey Report CR/04/064N: 1-86.

HR Wallingford, ABPmer and Cefas (2007), 'Dynamics of scour pits and scour protection - Synthesis report and recommendations (Sed02)'.

Intergovernmental Panel on Climate Change (IPCC) (2021), 'IPCC Sixth Assessment Report'. Available from: https://www.ipcc.ch/report/ar6/wg1 [Accessed: October 2023].

IPCC, (2023), 'Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]'. IPCC, Geneva, Switzerland, 184 pp., doi: 10.59327/IPCC/AR6-9789291691647.

Joint Nature Conservation Committee (2012), 'Inshore and Offshore Special Area of Conservation: Pobie Bank Reef SAC Selection Assessment Document'. Version 5.0. October 2012.

JNCC (2023), 'Protected Annex I Reefs in offshore SACs - polygon data - WMS layer 2023'. https://hub.jncc.gov.uk/assets/dfc01272-7ea5-41ea-ac04-c89eb848a768 [Accessed: February 2024).

Lambkin, D.; Harris, J.; Cooper, W.; Coates, T. (2009), 'Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment: Best Practice Guide', Report No. COWRIE COAST-07-08, Report by ABP Marine Environmental Research Ltd (ABPmer).

Marine Scotland (2022), 'The Marine Scotland NMPi Maps'. Available from: https://marinescotland.atkinsgeospatial.com/nmpi [Accessed: October 2023].

Marine Scotland Science (2023), 'Finite Volume Community Ocean Model'. [online] Marine.gov.scot. Available at: https://marine.gov.scot/information/finite-volume-community-ocean-model [Accessed: October 2023]

Marine Scotland-Licensing Operations Team (MS-LOT) (2018), 'Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications'. Available from: https://www.gov.scot/publications/marine-scotland-consenting-licensing-manual-offshore-wind-wave-tidal-energy-applications/ [Accessed: October 2023].

Maxwell, S.M., Kershaw, F., Locke, C.C., Conners, M.G., Dawson, C., Aylesworth, S., Loomis, R. and Johnson, A.F. (2022), 'Potential impacts of floating wind turbine technology for marine species and habitats'. Journal of Environmental Management, 307:114577.

McDonald, R.E. (2010) 'Understanding the impact of climate change on Northern Hemisphere extra-tropical cyclones', Climate Dynamics, 37(7–8), pp. 1399–1425. doi:10.1007/s00382-010-0916-x.

Miller, P.I., Xu, W., Lonsdale, P. (2014), 'Seasonal shelf-sea front mapping using satellite ocean colour to support development of the Scottish MPA network'. Scottish Natural Heritage Commissioned Report No. 538.

Moray Offshore Renewables Ltd (MORL) (2012), 'Technical Appendix 3.4 A – Metocean and Coastal Processes Baseline', Moray Offshore Renewables Limited Environmental Statement.

Moray Offshore Renewables Ltd (MORL) (2014), 'Physical Environment (Offshore). Chapter 3.1 Hydrodynamic, Sedimentary, and Coastal Processes', Moray Offshore Renewables Limited Environmental Statement.

Mykura, W. (1976), 'Orkney and Shetland. British regional geology'. Edinburgh : Edinburgh: Her Majesty's Stationery Office Natural Environment Research Council.

National Aeronautics and Space Administration (NASA) (2021), 'Sea Level Projection Tool – NASA Sea Level Change Portal'. Available from: https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool [Accessed: October 2023].

National Tide and Sea Level Facility (NTSLF) (2020), Available from:www.ntslf.org [Accessed: October 2023].

Natural England (2018), 'Offshore wind cabling: ten years experience and recommendations'.

Natural England (2022), 'Best Practice Advice for Evidence and Data Standards for offshore renewables projects'.

Palmer, M.D., Howard, T., Tinker, J., Lowe, J.A., Bricheno, L., Calvert, D., Edwards, T., Gregory, J., Harris, G. and Krijnen, J. (2018), 'UKCP18 Marine Projection Report [UK Climate Projections (UKCP)]', Met Office, UK.

Platt, N.H. and Cartwright, J.A. (1998), 'Structure of the East Shetland platform, northern North Sea', Petroleum Geoscience, 4(4), pp. 353–362. doi:10.1144/petgeo.4.4.353.

Ramsay, D.L. & Brampton, A.H. (2000), 'Coastal Cells in Scotland: Cell 1– Shetland', Scottish Natural Heritage Research, Survey and Monitoring Report No 145. 2000.

Scottish Natural Heritage (SNH) (2011), 'Dales Voe Site of Special Scientific Interest: Site Management Statement'.

Sepa (2021), 'Shetland Local Plan District (LPD 4). Draft flood risk management plans 2022-2028'. Available from: https://www.shetland.gov.uk/downloads/file/3413/lpd4-shetland-full-frmp-consultation-pdf. [Accessed: November 2023].

Shetland Marine Planning Partnership (SMPP) (2021), 'Shetland Coastal Character Assessment', Shetland Marine Planning Partnership

SNH and JNCC (2012), 'Large-scale MPA search features – Case Studies. A paper produced for the 4th MPA Stakeholder Workshop, Heriot-Watt University, 14-15 March 2012'. Produced by SNH and JNCC for the Scottish MPA Project. Available from: https://www.nature.scot/landscapes-and-habitats/habitat-types/coast-and-seas/large-scale-features-and-marine-protected-areas. [Accessed: October 2023].

Chapter 7 – Marine Water and Sediment Quality

BERR (2008), 'Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry. Department for Business Enterprise and Regulatory Reform in associations with Defra'. https://tethys.pnnl.gov/sites/default/files/publications/Cabling_Techniques_and_Environmental_Effects.pdf [Accessed: November 2023].

BSI (2015), 'Environmental impact assessment for offshore renewable energy projects – Guide', Standard number PD 6900:2015.

Cefas (2016), 'Suspended Sediment Climatologies Around the UK', https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584621/CEFAS_2016_Suspended_Sediment_Climatologies_around_the_UK.pdf [Accessed: October 2023].

Environment Agency (2016), 'Clearing the Waters for All' https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters.

Marine Scotland (2022), 'Contaminant data in sediment used in the 2020 assessment of the UK's Clean Seas Environment Monitoring Program (CSEMP)', https://data.marine.gov.scot/dataset/2020-csemp-assessment-contaminant-and-biological-effect-data-1999-2019/resource/7b9282d5#{view-graph:{graphOptions:{hooks:{processOffset:{},bindEvents:{}}}},graphOptions:{hooks:{processOffset:{},bindEvents:{}}},view-map:{lonField:!longitude,latField:!latitude}} [Accessed: October 2023].

Marine Scotland (NMPi) (2017a), 'Annual Mean Sea Surface Salinity (‰) – Climatology of the North-West European Continental Shelf 1971-2000', [https://marine.gov.scot/maps/74 [Accessed: October 2023].

Marine Scotland (NMPi) (2017b), 'Annual Mean Surface Temperature (°C) – Climatology of the North-West European Continental Shelf for 1971-2000', https://marine.gov.scot/maps/72[Accessed: October 2023].

Marine Scotland (NMPi) (2017c), 'Carbon Budget and Blue Carbon Stores' – SNH Commissioned Report 761 2014', https://marine.gov.scot/maps/72 [Accessed: October 2023].

Marine Scotland (2017c), 'Pre-disposal Sampling Guidance. Version 2-November 2017'. https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/pre-disposal-sampling-guidance/pre-disposal-sampling-guidance/govscot%3Adocument/Pre-disposal%2Bsampling%2Bguidance.pdf [Accessed: June 2023].

Marine Scotland (2018), 'Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications'. https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-paper/2018/10/marine-scotland-consenting-licensing-manual-offshore-wind-wave-tidal-energy-applications/documents/00542001-pdf/00542001-pdf/govscot%3Adocument/00542001.pdf [Accessed: June 2023].

Natural Resources Wales (NRW), the Northern Ireland Environment Agency (NIEA) and the Scottish Environment Protection Agency (SEPA), (2018), 'Works and maintenance in or near water: GPP 5. Version 1.2 February 2018'. https://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf [Accessed: October 2023].

Oslo and Paris (OSPAR) Conventions Commission (2022), 'Levels and trends in marine contaminants and their biological effects – CEMP Assessment report 2022', https://oap-cloudfront.ospar.org/media/filer_public/7c/3e/7c3e836c-2ac2-4b73-be1a-3dd50d083724/p00894_cemp_assessment_2022.pdf [Accessed: October 2023].

OSPAR (2009), 'OSPAR Assessment of the Environmental Impacts of Cables'. https://qsr2010.ospar.org/media/assessments/p00437_Cables.pdf [Accessed: June 2023].

Scottish Government (SMA) (2023), 'Scotland's Marine Atlas: Information for The National Marine Plan', https://www.gov.scot/publications/scotlands-marine-atlas-information-for-the-national-marine-plan [Accessed: October 2023].

Scottish Government and SEPA (2021), 'Welcome to the 2021 Update to the Water Environment Hub', https://informatics.sepa.org.uk/RBMP3/ [Accessed: October 2023].

SEPA (2019), 'Urban Waste Water Treatment Directive Sensitive Areas',https://www.gov.scot/publications/urban-waste-water-treatment-sensitive-areas-map/ [Accessed October 2023]

SEPA (2022), 'Shellfish Water Protected Areas', https://www.sepa.org.uk/environment/water/shellfish-water-protected-areas7 [Accessed: October 2023].

Scottish Environment Protection Agency (SEPA) (2022), 'Bathing Water Profiles'. https://www2.sepa.org.uk/bathingwaters/Locations.aspx [Accessed: June 2023].

SGS United Kingdom Limited (2018), 'Chemical and Macrobenthic Monitoring in Sullom Voe Sediments – 2018'. Available at: https://soteag.org.uk/wp-content/uploads/2019/07/2018-SOTEAG-Chemical-Monitoring.pdf [Accessed 15 Jan 2024].

UK Marine Monitoring and Assessment Strategy (UKMMAS) Community (2010), 'Charting Progress 2', https://tethys.pnnl.gov/sites/default/files/publications/UKMMAS_2010_Charting_Progress_2.pdf [Accessed: October 2023]

Chapter 8 – Benthic, Subtidal and Intertidal Ecology

ABPmer, Met Office and POL (2008), 'Atlas of UK Marine Renewable Energy Resources: Atlas Pages. A Strategic Environmental Assessment Report, March 2008'. BP Marine Environmental Research Ltd. Produced for BERR. http://www.renewables-atlas.info/ [Accessed: November 2023].

Burrows, M. T., Kamenos, N. A., Hughes, D. J., Stahl, H., Howe, J. A., and Tett, P. (2014), 'Assessment of carbon budgets and potential blue carbon stores in Scotland's coastal and marine environment'. Scottish Natural Heritage Commissioned Report No. 761. https://www.nature.scot/doc/naturescot-commissioned-report-761-assessment-carbon-budgets-and-potential-blue-carbon-stores [Accessed: November 2023].

Centre for Fisheries and Aquaculture Science (Cefas) (2004), 'Guidance note for Environmental Impact Assessment in respect of FEPA (Food and Environment Protection Act 1985) and CPA (Coastal Protection Act 1949) requirements. Version 2 - November 2004'. Prepared by CEFAS on behalf of the Marine Consents and Environment Unit (MCEU).

Centre for Fisheries and Aquaculture Science (Cefas) (2010), 'Strategic Review of Offshore Windfarm Monitoring Data Associated with FEPA Licence Conditions'. https://tethys.pnnl.gov/publications/strategic-review-offshore-wind-farm-monitoring-data-associated-fepa-license-conditions [Accessed: November 2023].

Chartered Institute for Ecology and Environmental Management (CIEEM) (2010), 'Guidelines for Ecological Impact Assessment in Britain and Ireland. Marine and Coastal'. Final Document, August 2010.

Chartered Institute for Ecology and Environmental Management (CIEEM) (2018; updated 2019), 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1'. Chartered Institute of Ecology and Environmental Management (Winchester).

European Commission, Directorate-General for Environment (2021), 'Guidance document on wind energy developments and EU nature legislation'. Publications Office of the European Union.

European Marine Observation and Data Network (EMODnet) (2021), 'EMODnet broad scale seabed habitat map for Europe (EUSeaMap) (2021) EUNIS 2019 habitat type'. https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/ [Accessed: November 2023].

Gill, A. B. and Bartlett, M. D. (2010), 'Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel'. Scottish Natural Heritage Commissioned Report.

Holmes, R., Bulat, J., Henni, P., Holt, J., James, C., Kenyon, N., Leslie, A., Long, D., Musson, R., Pearson, S. and Stewart, H. (2004), 'DTI Strategic Environmental Assessment Area 5 (SEA5): Seabed and superficial geology and processes', British Geological Survey Report CR/04/064N: 1-86.

Hutchison, Z., Gill, A., Sigray, P., He, H. and King, J. (2020), 'Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species', Scientific Reports, 10(1): 4219. https://www.nature.com/articles/s41598-020-60793-x [Accessed: November 2023].

International Maritime Organization (IMO) (2019), 'Ballast Water Management Convention and Guidelines'. https://www.imo.org/en/OurWork/Environment/Pages/BWMConventionandGuidelines.aspx [Accessed: November 2023].

Jakubowska, M., Urban-Malinga, B., Otremba, Z. and Andrulewicz, E. (2019), 'Effect of low frequency electromagnetic field on the behaviour and bioenergetics of the polychaete Hediste diversicolor', Marine Environmental Research, 150: 104766.

Joint Nature Conservation Committee (2012), 'Inshore and Offshore Special Area of Conservation: Pobie Bank Reef SAC Selection Assessment Document'. Version 5.0. October 2012.

JNCC (2013), 'Offshore and Inshore Special Area of Conservation Pobie Bank Reef Conservation Objectives and Advice on Operations'. Version 3.0. March 2013.

JNCC (2023), 'Protected Annex I Reefs in offshore SACs - polygon data - WMS layer 2023'. https://hub.jncc.gov.uk/assets/dfc01272-7ea5-41ea-ac04-c89eb848a768 [Accessed: February 2024).

Judd, A. (2012), 'Guidelines for data acquisition to support marine environmental assessments for offshore renewable energy projects'. Cefas contract report: ME5403 - Module 15.

Love, M. S., Nishimoto, M. M., Clark, S., McCrea, M. and Bull, A. S. (2017), 'Assessing potential impacts of energized submarine power cables on crab harvests', Continental Shelf Research, 151: 23-29.

Macreadie, P. I., Anton, A., Raven J. A. (2019), 'The future of Blue Carbon science', Nature Communications, 10: 3998.

MAGICMap (2023), 'MAGICMap'. Natural England. https://magic.defra.gov.uk/ [Accessed: November 2023].

Marine Scotland (2016), 'Northern North Sea Proposal'. https://fiskeristyrelsen.dk/fileadmin/user_upload/Fiskeristyrelsen/Beskyttede_omraader/Natura_2000/Natura_2000_og_fiskeriregulering_frem_mod_2020/northern-north-sea-proposal.pdf [Accessed: November 2023].

Marine Scotland (2020), 'Offshore Wind Energy in Scottish Waters: Regional Locational Guidance'. https://www.gov.scot/publications/sectoral-marine-plan-regional-locational-guidance [Accessed: November 2023].

Marine Scotland (2012), 'Report to the Scottish Parliament on Progress to Identify a Scottish Network of Marine Protected Areas. Annex D Sites of Special Scientific Interest (SSSIs)'. https://www.gov.scot/publications/report-scottish-parliament-progress-identify-scottish-network-marine-protected-areas/pages/22/. [Accessed: November 2023].

Ocean Ecology (2023), 'Arven Offshore Wind Farm. Benthic Characterisation Survey 2023: Survey Report. November 2023. Report to Arven Offshore Wind Farm Limited.

Oslo-Paris Convention (OSPAR) Commission (2008), 'OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development. Report Reference number: 2008-3'.

Patullo, B. W. and Macmillan D. L. (2007), 'Crayfish respond to electrical fields', Current Biology, 17: R83-R84.

RenewableUK (2013), 'Cumulative Impact Assessment Guidelines - Guiding Principles for Cumulative Impact Assessment in Offshore Wind Farms'.

Riley, T., Shucksmith, R., & Mouat, B. (2024), Distribution modelling of the Shetland Islands benthic habitats. UHI Shetland. https://doi.org/10.13140/RG.2.2.35769.58724.

Scott, K., Harsanyi, P. and Lyndon, A. R. (2018), 'Understanding the effects of electromagnetic field emissions from marine renewable energy devices (MREDs) on the commercially important edible crab, Cancer pagurus (L.)', Marine Pollution Bulletin, 131: 580-588.

Scott, K., Harsanyi, P., Easton, B. A. A., Piper, A. J. R., Rochas, C. M. V. and Lyndon, A. R. (2021), 'Exposure to Electromagnetic Fields (EMF) from Submarine Power Cables Can Trigger Strength-Dependent Behavioural and Physiological Responses in Edible Crab, Cancer pagurus (L.)', Journal of Marine Science and Engineering, 9: 776.

Scottish Government (2020), 'Appropriate Assessment for Sectoral Marine Plan for Offshore Wind Energy'. https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2020/10/sectoral-marine-plan-appropriate-assessment2/documents/appropriate-assessment-sectoral-marine-plan-offshore-wind-energy-2020/appropriate-assessment-sectoral-marine-plan-offshore-wind-energy-2020/govscot%3Adocument/appropriate-assessment-sectoral-marine-plan-offshore-wind-energy-2020.pdf [Accessed February 2024].

Steullet, P., Edwards, D. H. and Derby, C. D. (2007), 'An electric sense in crayfish?', Biological Bulletin, 213: 16-20.

Tricas, T. and Gill, A. (2011), 'Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species'. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

Tyler-Walters, H., Tillin, H. M., d'Avack, E. A. S., Perry, F. and Stamp, T. (2018), 'Marine Evidence-based Sensitivity Assessment (MarESA) - A Guide'. Marine Life Information Network (MarLIN). Marine Biological Association of the UK, Plymouth, pp. 91. https://www.marlin.ac.uk/publications [Accessed: November 2023].

Ugolini, A. and Pezzani, A. (1995), 'Magnetic compass and learning of the Y, axis (sea-land) direction in the marine isopod Idotea baltica basteri', Animal Behaviour, 50(2): 295-300.

Woodruff, D. L., Schultz, I. R., Marshall, K. E., Ward, J. A. and Cullinan, V. I. (2012), 'Effects of Electromagnetic Fields on Fish and Invertebrates: Task 2.1. 3: Effects on Aquatic Organisms-Fiscal Year 2011 Progress Report-Environmental Effects of Marine and Hydrokinetic Energy (No. PNNL-20813 Final)'. Pacific Northwest National Lab. (PNNL), Richland, WA (United States).

Chapter 9 – Fish and Shellfish Ecology

ABPmer, Met Office and POL (2008), 'Atlas of UK Marine Renewable Energy Resources: Atlas Pages. A Strategic Environmental Assessment Report, March 2008'. BP Marine Environmental Research Ltd. Produced for BERR. http://www.renewables-atlas.info/ [Accessed: November 2023].

Andersson, M., Sigray, P. and Persson, L. (2011), 'Operational Wind Farm Noise and Shipping Noise Compared with Estimated Zones of Audibility for Four Species of Fish'. Journal of The Acoustical Society of America. Vol.129. 10.

Anderwald, P., Evans, P. G. H., Dyer, R., Dale, A., Wright, P. J. W. and Hoelzel, A.R. (2012), 'Spatial scale and environmental determinants in minke whale foraging behaviour'. Marine Ecological Progress Series 450: 259-274.

Beatrice Offshore Wind Limited (2021), 'Beatrice Offshore Windfarm Cod Spawning Survey Results – Technical Report'. July 2021. https://marine.gov.scot/data/mfrag-main-group-beatrice-offshore-windfarm-post-construction-cod-spawning-survey-technical.

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014), 'Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments'. Scottish Natural Heritage Commissioned Report No. 791.

Blyth-Skyrme, R. E. (2010), 'Options and opportunities for marine fisheries mitigation associated with windfarms'. Final report for Collaborative Offshore Wind Research into the Environment contract FISHMITIG09. COWRIE Ltd, London. 125 pp. https://tethys.pnnl.gov/sites/default/files/publications/Blyth-Skyrme-2010.pdf [Accessed: November 2023].

Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2004), 'Guidance note for Environmental Impact Assessment in respect of FEPA (Food and Environment Protection Act 1985) and CPA (Coastal Protection Act 1949) requirement–s. Version 2 - June 2004. Prepared by CEFAS on behalf of the Marine Consents and Environment Unit (MCEU)'.

Chartered Institute for Ecology and Environmental Management (CIEEM) (2010), 'Guidelines for Ecological Impact Assessment in Britain and Ireland'. Marine and Coastal. Final Document, August 2010.

Chartered Institute for Ecology and Environmental Management (CIEEM) (2018), 'Guidelines for Ecological Impact Assessment in the UK and Ireland'. Terrestrial, Freshwater and Coastal. Chartered Institute of Ecology and Environmental Management, Winchester. https://cieem.net/wp-content/uploads/2019/02/Combined-EcIA-guidelines-2018-compressed.pdf [Accessed: November 2023].

Coull, K. A., Johnstone, R. and Rogers S. I. (1998), 'Fisheries Sensitivity Maps in British Waters'. Published and distributed by UKOOA.

Dekeling, R., Tasker, M., Van Der Graaf, S., Ainslie, M., Andersson, M., André, M., Borsani, J., Brensing, K., Castellote, M., Cronin, D., Dalen, J., Folegot, T., Leaper, R., Pajala, J., Redman, P., Robinson, S., Sigray, P., Sutton, G., Thomsen, F., Werner, S., Wittekind, D. and Young, J. (2014), 'Monitoring Guidance for Underwater Noise in European Seas- Part II: Monitoring Guidance Specifications', Dekeling, R., Tasker, M., Ferreira, M. and Zampoukas, N. editor(s), EUR 26555, Publications Office of the European Union, Luxembourg, 2014, ISBN 978-92-79-36339-9, doi:10.2788/27158, JRC88045.

Ellis, J., Cruz-Martinez, A., Rackham, B. and Rodgers, S. (2004), 'The Distribution of Chondrichthyan fishes around the British Isles and implications for conservation'. Journal of Northwest Atlantic Fishery Science 35: 195-213.

Ellis, J. R., Milligan, S., Readdy, L., South, A., Taylor, N. and Brown, M. (2010), 'Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones)'.

Ellis, J. R., Milligan, S.P. Readdy, L. Taylor, N. and Brown, M.J. (2012), 'Spawning and nursery grounds of selected fish species in UK waters'. Cefas Scientific Series Technical Report 147.

European Marine Observation and Data Network (EMODnet) (2023), 'European Marine Observation and Data Network (EMODnet) Bathymetry data'. https://portal.emodnet-bathymetry.eu [Accessed: November 2023].

Franco A., Smyth K., Thomson S. (2022), 'Developing Essential Fish Habitat maps for fish and shellfish species in Scotland. Report to the Scottish Government, December 2022. https://www.gov.scot/publications/developing-essential-fish-habitat-maps-fish-shellfish-species-scotland-report/.

Fraser S., Angus C., McAllister M., Powell A., Ayres S., Harlow L., (2022), Overview of annual Shetland Inshore Fish Survey (SIFS) data (2011 - 2022): catch rates and size compositions of commercial demersal fish species. UHI Shetland report. pp 22

Gilbey, J., Sampayo, J., Cauwelier, E., Malcolm, I., Millidine, K., Jackson, F. and Morris, D. J. (2021), 'A national assessment of the influence of farmed salmon escapes on the genetic integrity of wild Scottish Atlantic salmon populations'. Scottish Marine and Freshwater Science Vol 12 No 12, 70pp. DOI: 10.7489/12386-1.

González-Irusta, J. M., Watret, R. and Aires, C. (2014), 'Updating Fisheries Sensitivity Maps in British Waters'. Scottish Marine and Freshwater Science Report Vol 5 No 10.

González-Irusta, J. M. and Wright, P. J. (2016), 'Spawning ground of Atlantic cod (Gadus morhua) in the North Sea'. ICES Journal of Marine Science 73(2): 304-315.

González-Irusta, J. M. and Wright, P. J. (2016), 'Spawning grounds of haddock (Melanogrammus aeglefinus) in the North Sea and West of Scotland'. Fisheries Research Volume 183, November 2016, Pages 180-191.

González-Irusta, J. M. and Wright, P. J. (2017), 'Species Distribution - Spawning grounds of whiting (Merlangius merlangus) in the North Sea. Fisheries Research Volume 195, November 2017, Pages 141-151.

Grabowski, T. B, Thorsteinsson, V. and Marteinsdóttir, G. (2009), 'Assessing the lekking hypothesis for the mating system of Atlantic cod (Gadus morhua) using electronic data-storage tags'. ICES CM 2009/B:01.

Hawkins, A. D. and Popper, A. N. (2016), 'A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates'. ICES Journal of Marine Science, 74/3, pp. 635–651.

Hawkins, A. D., Pembroke, A. E. and Popper, A. N. (2014), 'Information gaps in understanding the effects of noise on fishes and invertebrates'. Reviews in Fish Biology and Fisheries, 25, pp. 39–64.

HM Government (2011), 'UK Marine Policy Statement'. https://www.gov.uk/government/publications/uk-marine-policy-statement [Accessed: November 2023].

Hutchison, Z. L., Gill, A. B., Sigray, P., He, H., and King, J. W. (2020), 'Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species'. Scientific Reports 10(1):4219, https://doi.org/10.1038/s41598-020-60793-x.

International Council for the Exploration of the Sea (ICES) (2010), 'Fish trawl survey: ICES North Sea International Bottom Trawl Survey for commercial fish species'. ICES Database of trawl surveys (DATRAS). The International Council for the Exploration of the Sea, Copenhagen. 2010. http://ecosystemdata.ices.dk [Accessed: November 2023].

International Maritime Organization (IMO) (2019), 'Ballast Water Management Convention and Guidelines'. https://www.imo.org/en/OurWork/Environment/Pages/BWMConventionandGuidelines.aspx [Accessed: November 2023].

Judd, A. (2012), 'Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects'. Cefas contract report: ME5403.

Keltz, S. and Bailey, N. (2010), 'Fish and Shellfish Stocks'. Published by Marine Scotland, The Scottish Government. ISSN 2044-0359.

Linley, E. A. S., Wilding, T. A., Hawkins, A. J. S. and Mangi, S. (2007), 'Review of the Reef Effects of Offshore Wind Farm Structures and their Potential for Enhancement and Mitigation'. Report from PML Applications Ltd and the Scottish Association for Marine Science to the Department for Business, Enterprise and Regulatory Reform (BERR), Contract No. RFA / 005 / 0029P.

Malcome, A., Godfrey, J and Youngson, A.F. (2010), 'Review of Migratory Routes and Behaviour of Atlantic Salmon, Sea Trout and European Eel In Scotland's Coastal Environment: Implacations For The Development of Marine Renewables'. Report from the Scottish Marine and Freshwater Science and The Scottish Government. Marine Scotland Science. ISSN:2042-7722.

Marine Management Organisation (MMO) (2020), 'UK Sea Fisheries Statistics 2019'. https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2019 [Accessed: November 2023].

Marine Management Organisation (MMO) (2021), 'UK Sea Fisheries Statistics 2021'. UK_Sea_Fisheries_Statistics_2021.pdf (publishing.service.gov.uk) [Accessed: November 2023].

Marine Management Organisation (MMO) (2023), 'UK and foreign vessels landings by UK port and UK vessel landings abroad: provisional data'. https://www.gov.uk/government/publications/2023-uk-and-foreign-vessels-landings-by-uk-port-and-uk-vessel-landings-abroad-provisional-data [Accessed: November 2023].

Marine Scotland (2020), 'Sharks, skates and rays'. https://blogs.gov.scot/marine-scotland/2020/08/13/sharks-skates-and-rays/ [Accessed: November 2023].

Marine Scotland (2023a), 'Maps NMNPi – Salmon and Sea Trout'. https://marinescotland.atkinsgeospatial.com/nmpi/default.aspx?layers=843 [Accessed: November 2023].

Marine Scotland (2023b), 'Maps NMPi – Basking Shark Sightings'. https://marinescotland.atkinsgeospatial.com/nmpi/default.aspx?layers=843 [Accessed: November 2023].

MarLIN (2022), 'MarESA'. https://www.marlin.ac.uk/sensitivity/sensitivity_rationale [Accessed: November 2023].

Natural England (2021a), 'Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards - Phase I'. https://naturalengland.blog.gov.uk/2022/04/13/offshore-wind-best-practice-advice-to-facilitate-sustainable-development/ [Accessed: November 2023].

Natural England (2021b), 'Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards - Phase III'. https://naturalengland.blog.gov.uk/2022/04/13/offshore-wind-best-practice-advice-to-facilitate-sustainable-development/ [Accessed: November 2023].

Oslo-Paris Convention (OSPAR) Committee (2008), 'OSPAR Guidance on Environmental Considerations for Offshore Wind-Farm Development'.

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., Coombs, S., Ellison, W. T., Gentry, R. L., Halvorsen, M. B., Løkkeborg, S., Rogers, P. H., Southall, B. L., Zeddies, D. G. and Tavolga, W. N. (2014), 'S3/SC1.4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards committee S3/SC1 and registered with ANSI'. American National Standards Institute.

RenewableUK (2013), 'Cumulative Impact Assessment Guidelines - Guiding Principles for Cumulative Impact Assessment in Offshore Wind Farms'.

RWE (2022), 'Awel y Môr Environmental Statement. Chapter 6: Fish and Shellfish Ecology'. PINS Document Reference: 6.2.5. APFP Regulation 5(2)(a).

Scott, K., Harsanyi, P., Easton, B. A., Piper, A. J., Rochas, C. and Lyndon, A. R. (2021), 'Exposure to Electromagnetic Fields (EMF) from Submarine Power Cables Can Trigger Strength-Dependent Behavioural and Physiological Responses in Edible Crab, Cancer pagurus (L.)'. Journal of Marine Science and Engineering, 9(7), p.776.

Scottish Government (2011), 'Scotland's Marine Atlas: Information for the national marine plan, Scottish Government'. The Scottish Government. https://www.gov.scot/publications/scotlands-marine-atlas-information-national-marine-plan/pages/34/ [Accessed: November 2023].

Tricas, T., and Gill, A. (2011), 'Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species'. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

Walker, R., Weiss, L., Froján, C. and Basteri, D. (2009), 'Strategic Review of Offshore Wind Farm Monitoring Data Associated with FEPA Licence Conditions: Benthic Ecology (Report No. ME1117)'. Report by Centre for Environment Fisheries and Aquaculture Science (CEFAS).

Chapter 10 – Marine Mammals

Benhemma-Le Gall, A., Graham, I. M., Merchant, N. D. and Thompson, P. M. (2021), 'Broad-scale responses of harbor porpoises to pile-driving and vessel activities during offshore windfarm construction', Frontiers in Marine Science, 8/664724: 1-18.

Carter, M. I. D., Boehme, L., Cronin, M. A., Duck, C. D., Grecian, W. J., Hastie, G. D., Jessopp, M., Matthiopoulos, J., McConnell, B. J., Miller, D. L., Morris, C. D., Moss, S. E. W., Thompson, D., Thompson, P. M. and Russell, D. J. F. (2022), 'Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management', Frontiers in Marine Science, 9/875869: 1-18.

Carter, M., Boehme, L., Duck, C., Grecian, W., Hastie, G., McConnell, B., Miller, D., Morris, C., Moss, S., Thompson, D., Thompson, P. and Russell, D. (2020), 'Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles'. Sea Mammal Research Unit', University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78

Cheney, B., Graham, I.M., Barton, T.R., Hammond, P.S. and Thompson, P.M. (2018), 'Site Condition Monitoring of bottlenose dolphins within the Moray Firth Special Area of Conservation: 2014-2016'. Scottish Natural Heritage Research Report No. 1021

CIEEM (2019), 'Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. September 2018 Version 1.1 – updated September 2019'. Chartered Institute of Ecology and Environmental Management, Winchester.

Copping, A. (2018), 'The State of Knowledge for Environmental Effects Driving Consenting/Permitting for the Marine Renewable Energy Industry. Prepared for Ocean Energy Systems On behalf of the Annex IV Member Nations', January 2018.

Czech-Damal, N. U., Dehnhardt, G., Manger, P., and Hanke, W. (2013.), 'Passive electroreception in aquatic mammals', Journal of Comparative Physiology A-Neuroethology Sensory Neural and Behavioral Physiology 199: 555-563.

European Commission (2021), 'European Union Guidance on wind energy developments and Natura 2000 legislation'.

Gilles, A., Authier, M., Ramirez-Martinez, N., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., Fernández Maldonado, C., Geelhoed, S., Kyhn, L., Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N., Owen, K., Saavedra, C., Vázquez-Bonales, J., Unger, B. and Hammond, P. (2023), 'Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys '

Graham, I. M., Farcas, A., Merchant, N. D. and Thompson, P. (2017), 'Beatrice Offshore Wind Farm: An interim estimate of the probability of porpoise displacement at different unweighted single-pulse sound exposure levels'. Prepared by the University of Aberdeen for Beatrice Offshore Windfarm Ltd.

Hague, E. L., Sinclair, R. R. and Sparling, C. E. (2020), 'Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters', Scottish Marine and Freshwater Science, 11/12.

Hammond, P., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M., Teilmann, J., Vingada, J. and Øie, N. (2021), 'Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys - revised June 2021'

Harwood, J., King, S., Schick, R., Donovan, C. and Booth, C. (2014), 'A Protocol for Implementing the Interim Population Consequences of Disturbance (PCoD) Approach: Quantifying and Assessing the Effects of UK Offshore Renewable Energy Developments on Marine Mammal Populations', REPORT NUMBER SMRUL-TCE-2013-014, Scottish Marine and Freshwater Science, 5/2.

Hastie, G. D., Russell, D. J. Benjamins, S. Moss, S. Wilson, B. and Thompson, D. (2016), 'Dynamic habitat corridors for marine predators; intensive use of a coastal channel by harbour seals is modulated by tidal currents', Behavioral Ecology and Sociobiology, 70: 2161-2174.

HiDef (2023a), 'Digital video aerial surveys of seabirds and marine megafauna at Project Arven: Interim Report April 2023 to September 2023'.

HiDef (2023b), 'Arven Offshore Wind Limited: Arven, High-resolution video aerial ornithological and marine megafauna survey monthly report – October 2023 – Survey 01'.

HiDef (2023c), 'Arven Offshore Wind Limited: Arven, High-resolution video aerial ornithological and marine megafauna survey monthly report – November 2023 – Survey 01'.

IAMMWG (2023), 'Review of Management Unit boundaries for cetaceans in UK waters (2023)', JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091.

IEEM (2010), 'Guidelines For Ecological Impact Assessment In Britain And Ireland Marine And Coastal Guidelines For Ecological Impact Assessment In The United Kingdom'. Winchester: Chartered Institute of Ecology and Environmental Management.

JNCC (2010a), 'JNCC guidelines for minimizing the risk of injury to marine mammals from using explosives'.

JNCC (2010b), 'Statutory nature conservation agency protocol for minimizing the risk of injury to marine mammals from piling noise'.

JNCC (2019a), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S1351 - Harbour porpoise (*Phocoena phocoena*)' UNITED KINGDOM.

JNCC (2019b), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S2032 - White-beaked dolphin (*Lagenorhynchus albirostris*)' UNITED KINGDOM

JNCC (2019c), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S2030 - Risso's dolphin (*Grampus griseus*)' UNITED KINGDOM

JNCC (2019d), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S2031 - White-sided dolphin (*Lagenorhynchus acutus*)' UNITED KINGDOM

JNCC (2019e), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S2618 - Minke whale (*Balaenoptera acutorostrata*)' UNITED KINGDOM.

JNCC (2019f), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S2027 - Killer whale (*Orcinus orca*)' UNITED KINGDOM

JNCC (2019g), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S1364 - Grey seal (*Halichoerus grypus*)' UNITED KINGDOM.

JNCC. '(2019h), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the

Directive from January 2013 to December 2018 Conservation status assessment for the species: S1365 - Common seal (*Phoca vitulina*)' UNITED KINGDOM.

Lacey, C., Gilles, A., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M., Teilmann, J., Sveegaard, S., Vingada, J., Viquerat, S., Øien, N., and Hammond, P. (2022), 'Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys'.

Marine Scotland (2014), 'Guidance on the Offence of Harassment at Seal Haul-out Sites'.

Marine Scotland .(2020), 'The protection of Marine European Protected Species from injury and disturbance Guidance for Scottish Inshore Waters (July 2020 Version)' https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/07/marine-european-protected-species-protection-from-injury-and-disturbance/documents/marine-european-protected-species-guidance-july-2020/marine-european-protected-species-guidance-july-2020/govscot%3Adocument/EPS%2Bguidance%2BJuly%2B2020.pdf [Accessed: November 2023].

Marine Scotland (2021), 'Pentland Floating Offshore Wind Farm Scoping Opinion'. https://marine.gov.scot/sites/default/files/pfowf_-_scoping_opinion.pdf [Accessed: November 2023].

Marine Scotland (2022), 'West of Orkney Windfarm Scoping Opinion'. https://marine.gov.scot/sites/default/files/scoping_opinion_-_west_of_orkney_-_june_2022.pdf [Accessed: November 2023].

Marine Scotland (2023), 'Caledonia Offshore Wind Farm Scoping Opinion'. https://marine.gov.scot/sites/default/files/scoping_opinion_12.pdf [Accessed: November 2023].

Marine Directorate (2023a), 'Salamander Offshore Wind Farm Scoping Opinion'. https://marine.gov.scot/sites/default/files/scoping_opinion_14.pdf [Accessed: November 2023].

Marine Directorate (2023b), 'Muir Mhòr Offshore Wind Farm Scoping Opinion'. https://marine.gov.scot/sites/default/files/scoping_opinion_-_september_2023.pdf [Accessed: November 2023].

Marubini, F. Gimona, A. Evans, P. G. Wright, P. J. and Pierce, G. J. (2009), 'Habitat preferences andinterannual variability in occurrence of the harbour porpoise *Phocoena phocoena* off northwest Scotland', Marine Ecology Progress Series, 381:297-310.

Morris, C., Duck, C. and Thompson, D (2021), 'Aerial surveys of seals in Scotland during the harbour seal moult, 2016-2019', NatureScot Research report.

Mrusczok, M. and Scullion, A. (2019), 'North Atlantic Killer Whales (Orcinus orca) Migrating between Iceland and Scotland. A Short Identification Catalogue'. http://orcaguardians.org/wp-content/uploads/2019/05/Killer-Whales-Migrating-between-Iceland-and-Scotland.pdf [Accessed: November 2023].

Shucksmith, R. J. (2017), 'Shetland Islands Marine Region State of the Marine Environment Assessment. NAFC Marine Centre UHI', Report for the Shetland Islands Marine Planning Partnership. 1-17.

Nature in Shetland (2023), 'Shetland Bird Club recent sightings (January to October 2023)' https://www.nature-shetland.co.uk/latest-sightings#:~:text=over%20Sumburgh%20Head.-,Cetacean%20Sightings%3A,pod%20at%20Stenness%20and%20Eshaness [Accessed: December 2023].

ORCA (2023), 'Whale and Dolphin sightings'. https://orca.org.uk/whale-dolphin-sightings [Accessed: November 2023].

OSPAR (2008), 'OSPAR Guidance on Environmental Considerations for Offshore Wind-Farm Development', Reference Number 2008-3.

Paxton, C., Scott-Hayward, L., Mackenzie, M., Rexstad, E. and Thomas, L. (2016), 'Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources'.

Pierpoint, C. (2008), 'Harbour porpoise (*Phocoena phocoena*) foraging strategy at a high energy, nearshore site in south-west Wales, UK', Journal of the Marine Biological Association of the UK, 88: 1167-1173.

Natural England (2023) POSEIDON: Changing the game for offshore wind and nature. Available at https://naturalengland.blog.gov.uk/2023/02/01/poseidon-offshore-wind-and-nature/ [Accessed April 2024].

Reid, J. B., Evans, P. G. and Northridge, S. P. (2003), 'Atlas of cetacean distribution in north-west European waters'. Joint Nature Conservation Committee.

SCOS (2019), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2018'

SCOS (2021), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2020'

SCOS (2022), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2021'

SCOS (2023), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2022'

Scullion, A., Harrop, H., Munro, K., Truluck, S. and Foote, A (2021), 'Scottish Killer Whale, Orcinus orca, Photo Identification Catalogue 2021'. https://www.yumpu.com/en/document/read/65508209/scottish-killer-whale-orcinus-orca-photo-id-catalogue-2021-working3 [Accessed: November 2023]

Smith, K., Date, G. and Waggitt, J (2021), 'Shetland Tidal Array Monitoring Report: Vantage point surveys', NOVA INNOVATION, EnFAIR-0347 Version 5.0

Southall, B., Finneran, J. J., Reichmuth, C., Nachtigall, P. E., Ketten, D. R., Bowles, A. E., Ellison, W. T., Nowacek, D. and Tyack, P. (2019), 'Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects', Aquatic Mammals 45: 125-232.

SeaWatch Foundation (2023), 'Sightings – Shetland' https://seawatchfoundation.org.uk/legacy_tools/region.php?output_region=1 [Accessed: November 2023].

Weir, C.R., Hodgins, N.K., Dolman, S.J. and Walters, A.E.M. (2019), 'Risso's dolphins (*Grampus griseus*) in a proposed Marine Protected Area off east Lewis (Scotland, UK)', 2010-2017, Journal of the Marine Biological Association of the United Kingdom, 99(3): 703-714.

Waggitt, J. J., Evans, P., Andrade, J., Banks, A. N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C. J., Durinck, J., Felce, T., Fijn, R. C., Garcia-Baron, I., Garthe, S., Geelhoed, S., Gilles, A., Goodall, M., Haelters, J., Hamilton, S., Hartny-Mills, L., Hodgins, N., James, K., Jessopp, M., Kavanagh, A., Leopold, M., Lohrengel, K., Louzao, M., Markones, N., Martinez-Cediera, J., O'Cadhla, O., Perry, S., Pierce, G., Ridoux, V., Robinson, K., Santos, M., Saavedra, C., Skov, H., Stienen, E., Sveegaard, S., Thompson, P., Vanermen, N., Wall, D., Webb, A., Wilson, J., Wanless, S. and Hiddink, J. (2020), 'Distribution maps of cetacean and seabird populations in the North-East Atlantic', Journal of Applied Ecology, 57:253-269.

Whyte, K., Russell, D., Sparling, C., Binnerts, B. and Hastie, G. (2020), 'Estimating the effects of pile driving sounds on seals: Pitfalls and possibilities', Journal Acoustic Society America, 147: 3948.

Baker, B., Meadows, M., Ruffino L., and Anderson, O.R. (2022), 'Towards better estimates of Manx shearwater and European storm-petrel population abundance and trends, demographic rates and at-sea distribution and behavior', JNCC Report No. 719.

Band, W. (2012), 'Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Wind Farms', Report by BTO, Report for The Crown Estate.

Beatrice Offshore Wind Farm (2019), 'Year 1 Post-construction Ornithological Monitoring Report', https://marine.gov.scot/sites/default/files/bowl_2019_post-con_monitoring_report_v2.2_30042021.pdf [Accessed: November 2023].

BirdLife International (2004), 'Birds in Europe: population estimates, trends and conservation status', Birdlife Conservation Series No. 12.

Bradbury, G., Trinder, M., Furness, B., Banks, A.N., Caldow, R.W.G. and Hume, D. (2014), 'Mapping Seabird Sensitivity to Offshore Wind farms', PloS ONE 9/9: e106366.

Brown, A. and Grice, P. (2005), 'Birds in England', (London: T and AD Poyser).

Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D and Dunn, T.E. (2023), 'Sebirds Count: A census of breeding seabirds in Britain and Ireland (2105-2021)', Lynx Edicions

Caneco, B. (2022), 'A Shiny App for a stochastic Collision Risk Model (sCRM) for seabirds', https://dmpstats.shinyapps.io/sCRM/ [Accessed: May 2023].

Cleasby, I.R., Owen, E., Wilson, L., Wakefield, E.D., O'Connell, P. and Bolton, M. (2020), 'Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping', Biological Conservation 241: 108375.

Cook, A.S.C.P., Humphreys, E.M., Bennet, F., Masden, E.A. and Burton, N.H. (2018), 'Quantifying avian avoidance of offshore wind turbines: current evidence and key knowledge gaps', Marine Environmental Research 140: 278-288.

Cook, A.S.C.P., Humphries, E.M., Masden, E.A., Burton, N.H.K. (2014), 'The avoidance rates of collision between birds and offshore turbines', Scottish Marine and Freshwater Science 5/16: 247.

Cook, A.S.C.P., Wright, L.J., Burton, N.H.K. (2012), 'A review of flight heights and avoidance rates of birds in relation to offshore wind farms', Report by BTO, Report No. 618.

Corallian Energy Limited (2022), 'Victory Field Development Environment Statement', https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1089579/Corallian_Victory_Development_ES-2022-003_06Jul22_Redacted.pdf [Accessed: October 2023].

Cramp, S. and Simmons, K.E.L. (1977 – 1994), 'The Birds of the Western Palearctic', (Oxford: University Press).

Davies, T.E., Carneiro, A.P., Tarzia, M., Wakefield, E., Hennicke, J.C., Frederiksen, M., Hansen, E.S., Campos, B., Hazin, C., Lascelles, B. and Anker‐Nilssen, T. (2021), 'Multispecies tracking reveals a major seabird hotspot in the North Atlantic', Conservation Letters 14/5: p.e12824.

Deakin, Z., Cook, A., Daunt, F., McCluskie, A., Morley, N., Witcutt, E., Wright, L., Bolton, M. (2022), 'A review to inform the assessment of the risk of collision and displacement in petrels and shearwaters from

offshore wind developments in Scotland', https://www.gov.scot/binaries/content/documents/govscot/publications/research-and-analysis/2022/12/review-inform-assessment-risk-collision-displacement-petrels-shearwaters-offshore-wind-developments-scotland/documents/review-inform-assessment-risk-collision-displacement-petrels-shearwaters-offshore-wind-developments-scotland/review-inform-assessment-risk-collision-displacement-petrels-shearwaters-offshore-wind-developments-scotland/govscot%3Adocument/review-inform-assessment-risk-collision-displacement-petrels-shearwaters-offshore-wind-developments-scotland.pdf [Accessed: November 2023].

Del Hoyo, J., Elliott, A. and Sargatal, J. (1992 – 2011), 'Handbook of the Birds of the World', (Madrid: Lynx Editions).

Dierschke, V., Furness, R.W. and Garthe, S. (2016), 'Seabirds and offshore wind farms in European waters: Avoidance and attraction', Biological Conservation, 202, 59-68.

Dierschke, V., Furness, R.W., Gray, C.E., Petersen, I.K., Schmutz, J., Zydelis, R. and Daunt, F. (2017), 'Possible behavioural, energetic and demographic effects of displacement of red throated divers', JNCC Report No 605.

Drewitt, A.L. and Langston, R.H.W. (2006), 'Assessing the impacts of wind farms on birds', Ibis 148: 4-7.

EU (2009), 'Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Codified version)', https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147 [Accessed: November 2023].

Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Robinson, A.E., Stroud, D.A., Wotton, S.R. and Balmer, D.E. (2019), 'Waterbirds in the UK 2017/18: The Wetland Bird Survey', BTO, RSPB and JNCC, in association with WWT.

Furness, R.W. (2015), 'Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS)', Natural England Commissioned Report No 164.

Furness, R.W. and Wade, H. (2012), 'Vulnerability of Scottish seabirds to offshore wind turbines', http://www.scotland.gov.uk/Resource/0040/00401641.pdf [Accessed: September 2022].

Furness, R.W., Garthe, S., Trinder, M., Matthiopoulos, J., Wanless, S. and Jeglinski, J. (2018), 'Nocturnal flight activity of northern gannets Morus bassanus and implications for modelling collision risk at offshore wind farms', Environmental Impact Assessment Review 73: 1-6.

Furness, R.W., Wade, H.M. and Masden, E.A. (2013), 'Assessing vulnerability of marine bird populations to offshore wind farms', Journal of Environmental Management 119: 56-66.

Garthe, S and Hüppop, O. (2004), 'Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index', Journal of Applied Ecology 41: 724- 734.

Goodale, M.W. and Milman, A. (2020), 'Assessing Cumulative Exposure of Northern Gannets to Offshore Wind Farms', Wildlife Society Bulletin 44/2: 252-259.

HiDef Ltd. (2015), 'Applicability of strategic digital aerial survey at sea of marine mammals and seabirds in Scotland', https://data.marine.gov.scot/dataset/applicability-strategic-digital-aerial-survey-sea-marine-mammals-and-seabirds-scotland [Accessed: June 2023].

Holling, M. and the Rare Breeding Birds Panel (2011), 'Rare breeding birds in the United Kingdom in 2009', British Birds 104: 476–537.

Horswill, C., O'Brien, S.H. and Robinson, R.A. (2017), 'Density dependence and marine bird populations: are wind farm assessments precautionary?', Journal of Applied Ecology 54: 1406-1414.

IUCN (2023), 'IUCN Red List', https://www.iucnredlist.org/ [Accessed: November 2023].

Jarrett, D., Cook, A.S.C.P., Woodward, I., Ross, K., Horswill, C., Dadam, D. and Humphreys, E.M. (2018), 'Short-term behavioural responses of wintering waterbirds to marine activity', Scottish Marine and Freshwater Science 9/7.

JNCC (n.d.), 'Offshore Wind Strategic Monitoring and Research Forum (OWSMRF)', https://jncc.gov.uk/our-work/owsmrf [Accessed: November 2023].

Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, E.H.K. (2014a), 'Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines', Journal of Applied Ecology 51/1: 31-41.

Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, N.H.K. (2014b), 'Corrigendum: Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines', Journal of Applied Ecology 51/4: 1126-1130.

Joint Nature Conservation Committee (JNCC) (2020), 'Seabird Monitoring Programme Online Database, http://jncc.defra.gov.uk/smp [Accessed: September 2022].

Joint Nature Conservation Committee (JNCC) and Statutory Nature Conservation Bodies (SNCBs) (2022), 'Joint SNCB Interim Displacement Advice Note', https://hub.jncc.gov.uk/assets/9aecb87c-80c5-4cfb-9102-39f0228dcc9a#:~:text=The%20Joint%20SNCB%20Interim%20Displacement,England%20and%20JNCC%20in%202012 [Accessed: May 2023].

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L.J. and Reid, J.B. (2010), 'An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs', JNCC Report No. 431.

Langston, R.H.W. (2010), 'Offshore wind farms and birds: Round 3 zones, extensions to Round 1 and Round 2 sites and Scottish Territorial Waters', RSPB Research Report No. 39.

Leopold, M.F. and Verdaat, H.J.P. (2018), 'Pilot field study: observations from a fixed platform on occurrence and behaviour of common guillemots and other seabirds in offshore wind farm Luchterduinen (WOZEP Birds-2)'. Wageningen Marine Research Report No. C068/18.

Masden, E.A., Haydon, D.T., Fox, A.D. and Furness, R.W. (2010), 'Barriers to movement: Modelling energetic costs of avoiding marine wind farms amongst breeding seabirds', Marine Pollution Bulletin 60: 1085-1091.

Masden, E.A., Reeve, R., Desholm, M., Fox, A.D., Furness, R.W. and Haydon, D.T. (2012), 'Assessing the impact of marine wind farms on birds through movement modelling', Journal of the Royal Society Interface 9: 2120-2130.

Mendel, B., Schwemmer, P., Peschko, V., Müller, S., Schwemmer, H., Mercker, M. and Garthe, S. (2019), 'Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of loons (Gavia spp.)', Journal of Environmental Management 231: 429-438.

Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (2004), 'Seabird populations of Britain and Ireland', (London: T. and AD Poyser).

Mobbs, D., Searle, K., Daunt, F. and Butler, A. (2020), 'A Population Viability Analysis Modelling Tool for Seabird Species: Guide for using the PVA tool (v2.0) user interface', https://github.com/naturalengland/Seabird_PVA_Tool/blob/master/Documentation/PVA_Tool_UI_Guidance.pdf [Accessed: May 2023].

Musgrove, A.J., Aebischer, N.J., Eaton, M.A., Hearn, R.D., Newson, S.E., Noble, D.G., Parsons, M., Risely, K. and Stroud, D.A. (2013), 'Population estimates on birds in Great Britain and the United Kingdom', British Birds 106: 64–100.

Nature Scot (n.d.), 'Advice on marine renewables development', https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/renewable-energy/marine-renewables/advice-marine-renewables-development [Accessed: November 2023].

NatureScot (2020), 'Guidance Note 9 – Guidance to support Offshore Wind Applications: Seasonal periods for Birds in the Scottish Marine Environment', https://www.nature.scot/doc/guidance-note-9-guidance-support-offshore-wind-applications-seasonal-periods-birds-scottish-marine [Accessed: November 2023].

NatureScot (2023a), 'Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds', Version 1: January 2023.

NatureScot (2023c), 'Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology – Advice for assessing collision risk of marine birds', Version 1: January 2023.

NatureScot (2023d), 'Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology – Recommendations for Seabird Population Viability Analysis (PVA), Version 1: January 2023.

NatureScot (2023b), 'Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for Marine Ornithology Baseline Characterisation Surveys and Reporting', Version 1: January 2023.

ORJIP (n.d.), 'Offshore Renewables Joint Industry Programme (ORJIP)', http://www.orjip.org.uk/ [Accessed: November 2023].

Pavat, D., Harker, A.J., Humphries, G., Keogan, K., Webb, A. and Macleod, K. (2023) Consideration of avoidance behaviour of northern gannet (Morus bassanus) in collision risk modelling for offshore wind farm impact assessments. NECR490. Natural England

Pearce-Higgins, J.W. (2021), 'Climate Change and the UK's Birds', British Trust for Ornithology Report, Thetford, Norfolk, https://www.bto.org/sites/default/files/publications/bto_climate_change_and_uk_birds_-_james_pearce-higgins_bto_web-compressed.pdf [Accessed: November 2023].

Robinson, R.A. (2005), 'Bird Facts: profiles of birds occurring in Britain and Ireland', BTO Research Report No. 407.

RSPB (n.d.), 'Birds of Conservation Concern 5', https://www.bto.org/sites/default/files/publications/bocc-5-a5-4pp-single-pages.pdf [Accessed: November 2023].

Scottish Government (n.d.), 'Marine renewable energy: Science and research', https://www.gov.scot/policies/marine-renewable-energy/science-and-research/ [Accessed: November 2023].

Scottish Government (2020), 'Sectoral marine plan: appropriate assessment', https://www.gov.scot/publications/sectoral-marine-plan-appropriate-assessment/pages/16/ [Accessed: October 2023].

Searle, K., Mobbs, D., Daunt, F. and Butler, A. (2019), 'A Population Viability Analysis Modelling Tool for Seabird Species', Natural England Commissioned Reports, Number 274.

Searle, K.J., Mobs, D.C., Butler, A., Furness, R.W., Trinder, M.N. and Daunt. F. (2018), 'Finding out the Fate of Displaced Birds', Scottish Marine and Freshwater Science Vol 9 No 8, 149pp.

Shetland Islands Council (2017), 'SEA Environmental Baseline Appendix III', https://www.shetland.gov.uk/downloads/file/4786/appendix-iii-environmental-baseline [Accessed: October 2023].

Shucksmith, R.J. (2017), 'Shetland Islands Marine Region State of the Marine Environment Assessment', https://www.shetland.uhi.ac.uk/t4-media/one-web/shetland/research/document/marine-spatial-planning/sirmp/Shetland-Islands-Marine-Region-State-of-the-Environment-Assessment--Final-2017-compressed.pdf [Accessed: November 2023].

Speakman, J., Gray, H. and Furness, L. (2009), 'University of Aberdeen report on effects of offshore wind farms on the energy demands of seabirds', Report to the DECC.

SSE Renewables (2022), 'Berwick Bank Wind Farm Offshore Environmental Impact Assessment, Appendix 11.4: Annex H: Sensitivity Analysis of Parameters and Assumptions in the SeabORD Model', Appendix 11.4, Annex H.

Stienen, E.W., Waeyenberge, V., Kuijken, E. and Seys, J. (2007), 'Trapped within the corridor of the southern North Sea: the potential impact of offshore wind farms on seabirds', In de Lucas, M., Janss, G.F.E. and Ferrer, M. (eds), Birds and Wind farms, (Madrid: Quercus).

Stone, C.J. Webb, A., Barton, C., Ratcliffe, N., Reed, T.C. Tasker, M.L. Camphuysen, C.J. and Pienkowski, M.W. (1995), 'An atlas of seabird distribution in north-west European waters', JNCC, Peterborough.

Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K. (2012), 'Seabird foraging ranges as a preliminary tool for identifying Marine Protected Areas', Biological Conservation 156: 53-61.

Tremlett, C.J., Morley, N. & Wilson, L.J. (2024), 'UK seabird colony counts in 2023 following the 2021-22 outbreak of Highly Pathogenic Avian Influenza, Research Report 76', RSPB

UK Centre for Ecology & Hydrology (n.d.), 'Cumulative Effects Framework for Key Ecological Receptors', https://www.ceh.ac.uk/our-science/projects/cumulative-effects-framework-key-ec [Accessed: November 2023].

Waggitt, J. J., Evans, P. G., Andrade, J., Banks, A. N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C. J., Durinck, J., Felce, T., Fijn, R. C., Garcia‐Baron, I., Garthe, S., Geelhoed, S. C., Gilles, A., Goodall, M., Haelters, J., Hamilton, S., Hiddink, J. G. (2019), 'Distribution maps of cetacean and seabird populations in the north‐east Atlantic', Journal of Applied Ecology, 57/2: 253‐269.

Wakefield, E.D., Bodey, T.W., Bearhop, S., Blackburn, J., Colhoun, K., Davies, R., Dwyer, R.G., Green, J.A., Grémillet, D., Jackson, A.L., Jessopp, M.J., Kane, A., Langston, R.H.W., Lescroël, A., Murray, S., Le Nuz,

M., Patrick, S.C., Péron, C., Soanes, L.M., Wanless, S., Votier, S.C. and Hamer, K.C. (2013), 'Space Partitioning Without Territoriality in Gannets', Science 341/6141: 68-70.

Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. and Baillie, S.R. (2002), 'The Migration Atlas: Movements of the birds of Britain and Ireland', (London: T. and A.D. Poyser).

Woodward, I., Thaxter, C.B., Owen, E. and Cook, A.S.C.P. (2019), 'Desk-based revision of seabird foraging ranges used for HRA screening', Report of work carried out by the British Trust for Ornithology on behalf of NIRAS and The Crown Estate, BTO Research Report No. 724.

Wright, L.J., Ross-Smith, V.H., Massimino, D., Dadam, D., Cook, A.S.C.P. and Burton, N.H.K. (2012), 'Assessing the risk of offshore windfarm development to migratory birds designated as features of UK Special Protection Areas (and other Annex I species)', Strategic Ornithological Support Services. Project SOSS-05, BTO Research Report No. 592.

Chapter 12- Seascape, Landscape and Visual Impact Assessment

CPRE, 'Light Pollution and Dark Skies interactive mapping'. https://www.cpre.org.uk/light-pollution-dark-skies-map/) [Accessed: November 2023].

Department for Business, Energy & Industrial Strategy (2022), 'UK Offshore Energy Strategic Environmental Assessment (OESEA 4), Environmental Report – Consultation' https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-4-oesea4 [Accessed: November 2023].

Historic Environment Scotland. Gardens and Designed Landscapes, Available online at: www.historicenvironment.scot/advice-and-support/listing-scheduling-and-designations/gardens-and-designed-landscapes/' [Accessed: November 2023].

Landscape Institute and Institute of Environmental Management and Assessment (2013), 'Guidelines for Landscape and Visual Impact Assessment, Third edition.'

Landscape Institute (2019), 'Visual Representation of Development Proposals Technical Guidance Note 06/19'

Landscape Institute (2021), 'Assessing landscape value outside national designations.'

National Trust for Scotland, 'Places' https://www.nts.org.uk/visit/places [Accessed November 2023].

NatureScot, 'NSA Special Qualities' https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/national-designations/national-scenic-areas/nsa-special-qualities [Accessed November 2023].

NatureScot (2010), 'The special qualities of the National Scenic Areas. Scottish Natural Heritage Commissioned Report No.374 (iBids and Project no 648).' Available online at: www.nature.scot/doc/naturescot-commissioned-report-374-special-qualities-national-scenic-areas [Accessed November 2023].

NatureScot (2012), 'Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape Guidance for Scoping an Environmental Statement.

NatureScot (2014), 'Wild Land Area descriptions' https://www.nature.scot/doc/wild-land-areas-map-and-descriptions-2014 [Accessed November 2023].

NatureScot (2017), 'Guidance Note Coastal Character Assessment.' Available online at: https://www.webarchive.org.uk/wayback/archive/20220426161613mp_/https://www.nature.scot/sites/default/files/2018-07/Guidance%20Note%20-%20Coastal%20Character%20Assessment.pdf. [Accessed November 2023].

NatureScot (2017), 'Visual Representation of Wind Farms Guidance Version 2.2.' Available online at: www.nature.scot/sites/default/files/2019-09/Guidance%20-%20Visual%20representation%20of%20wind%20farms%20-%20Feb%202017.pdf. [Accessed November 2023].

NatureScot (2019), 'Scottish Landscape Character Types Map and Descriptions.' www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions [Accessed November 2023]

NatureScot (2021), 'Guidance - Assessing the cumulative landscape and visual impact of onshore wind energy developments'. https://www.nature.scot/doc/guidance-assessing-cumulative-landscape-and-visual-impact-onshore-wind-energy-developments [Accessed November 2023].

Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005), 'An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).' Available online at: https://www.nature.scot/doc/naturescot-commissioned-report-103-assessment-sensitivity-and-capacity-scottish-seascape-relation [Accessed November 2023]

Scottish Government (2022), 'Guidance for applicants on using the design envelope for applications under Section 36 of the Electricity Act 1989.' Available online at: https://www.gov.scot/publications/guidance-applicants-using-design-envelope-applications-under-section-36-electricity-act-1989/ [Accessed November 2023]

Scottish Government (2023), 'National Planning Framework 4'.

Shetland Island Council (2021), 'Shetland Coastal Character Assessment (2nd Edition). https://www.shetland.uhi.ac.uk/research/marine-spatial-planning/marine-spatial-planning-publications/shetland-coastal-character-assessment-publications/ [Accessed November 2023]

Shetland Islands Council (2009), 'Core Paths Plan' https://www.shetland.gov.uk/downloads/download/145/core-paths-plan-maps [Accessed November 2023]

Shetland Islands Council (2014), 'Shetland Local Development Plan' https://www.shetland.uhi.ac.uk/research/marine-spatial-planning/shetland-islands-regional-marine-plan/ [Accessed November 2023]

Shetland Islands Marine Planning Partnership (2021), 'A Community Shaped by the Sea – Understanding community value and use of the Shetland coastline' https://www.shetland.uhi.ac.uk/research/marine-spatial-planning/shetland-islands-regional-marine-plan/coastal-values/ [Accessed November 2023]

Shetland Islands Marine Planning Partnership (2021), 'Shetland Islands Regional Marine Plan. NAFC Marine Centre UHI pp 158.'

Shetland Islands Marine Planning Partnership (2021), 'Shetland Islands Regional Marine Plan (Amended draft)' https://www.shetland.uhi.ac.uk/research/marine-spatial-planning/shetland-islands-regional-marine-plan/ [Accessed November 2023]

Slater, C. & Shucksmith, R.J. (2021), 'A Community Shaped by the Sea- Understanding community value and use of the Shetland coastline. A report prepared by Shetland UHI for the Shetland Marine Planning Partnership. Shetland UHI. 32pp.'

Slater, C., Shucksmith, R. (2021), 'The Shetland Coastal Character Assessment. Prepared by Shetland UHI on behalf of the Shetland Marine Planning Partnership. 303 pp'.

Chapter 13 – Commercial Fisheries

Blyth-Skyrme, R.E. (2010a), 'Options and opportunities for marine fisheries mitigation associated with windfarms'. Final report for Collaborative Offshore Wind Research into the Environment contract FISHMITIG09. COWRIE (Collaborative Offshore Wind Research Into the Environment) Ltd, London. 125 pp.

Blyth-Skyrme, R.E. (2010b), 'Options and opportunities for marine fisheries mitigation associated with windfarms: Summary report for COWRIE contract FISHMITIG09'. COWRIE Ltd, c/o Nature Bureau, Newbury, UK. 8pp.

Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2012), 'Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects'. Contract report: ME5403.

Department for Business, Enterprise and Regulatory Reform (BERR) (2008), 'Fisheries Liaison with Offshore Wind and Wet Renewables Group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers'.

European Maritime Safety Agency (EMSA) (2022), 'Fishing vessel route density data for annual period of 2021'.

European Subsea Cable Association (ESCA) (2018), 'European Subsea Cable Association Statement on vessels operating in the vicinity of subsea cables'.

European Union Data Collection Framework (EU DCF) database (2020), 'Data by quarter-rectangle: Tables and maps of effort and landings by ICES statistical rectangles for 2012 to 2016'. Available at: https://stecf.jrc.ec.europa.eu/web/stecf/dd/effort/graphs-quarter.

Fisheries Liaison with Offshore Wind and Wet Renewables group (FLOWW) (2015), 'FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds'.

Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW (2014), 'FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison'. January 2014.

Gray, M., Stromberg, P-L., Rodmell, D. (2016), 'Changes to fishing practices around the UK as a result of the development of offshore windfarms – Phase 1 (Revised)'. The Crown Estate, 121 pages. ISBN: 978-1-906410-64-3

International Cable Protection Committee (2009), 'Fishing and Submarine Cables - Working Together'.

International Council for the Exploration of the Sea (ICES) (2022), 'EU-registered vessel VMS data for vessels ≥12 m length for 2017. Spatial data layers of fishing intensity/pressure for EU vessels operating within ICES defined Celtic Seas Ecoregion and Greater North Sea Ecoregion'.

KIS-ORCA (Kingfisher Information Service – Offshore Renewable and Cable Awareness), 'Reducing Risks Whilst Fishing'. Available at: https://kis-orca.org/safety/reducing-risks-whilst-fishing/.

Marine Management Organisation (MMO) (2023a), 'IFISH database with landing statistics data for UK registered vessels for 2018 to 2022 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value'.

Marine Management Organisation (MMO) (2023b), 'Vessel Monitoring System data for non-UK registered vessels for 2020 indicating hours fishing for mobile and static vessels to a resolution of 200th of an ICES rectangle'.

Marine Management Organisation (MMO) (2018), 'IFISH database with landing statistics data for UK registered vessels for 2011 to 2018 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value'.

Marine Scotland MAPS NMPI,. Available at: https://marinescotland.atkinsgeospatial.com/nmpi/.

Marine Scotland (2020), 'Guidance on preparing a Fisheries Management and Mitigation Strategy ("FMMS"), DRAFT'. Available at fmms_draft_guidance_document_1.pdf (marine.gov.scot)

Shelmerdine R.L. and Mouat B. (2021), 'Mapping fisheries and habitats in the North and East Coast RIFG area'. NAFC Marine Centre UHI report. pp. 70.

UK Fisheries Economic Network and Seafish (2012), 'Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments'.

UK Hydrographic Office (UKHO) (2020), 'The Mariner's Handbook (NP100)', 12th Edition.

UK Oil and Gas (2015), 'Fisheries Liaison Guidelines - Issue 6'.

Xodus (2022), 'Good Practice Guidance for assessing fisheries displacement by other licensed marine activities'.

Chapter 14 – Aviation and Radar

CAA (April 2022), 'Air Navigation Order 2016/765'. https://www.caa.co.uk/uk-regulations/aviation-safety/civil-aviation-act-1982-the-ano-2016-the-rules-of-the-air-2015-and-the-dg-regulations-2002/the-civil-aviation-air-navigation-order-2016/ [Accessed: November 2023].

CAA (February 2016), 'CAP 764: Policy and Guidelines on Wind Turbines'. https://publicapps.caa.co.uk/docs/33/CAP764%20Issue6%20FINAL%20Feb.pdf [Accessed: November 2023].

CAA (February 2021), 'CAP 393: Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016'. https://publicapps.caa.co.uk/docs/33/CAP393%20Regulations%20made%20under%20powers%20in%20the

%20Civil%20Aviation%20Act%201982%20and%20the%20Air%20Navigation%20Order%202016.pdf [Accessed: November 2023].

CAA (February 2023), 'CAP 437: Standards for Offshore Helicopter Landing Areas'. https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=523 [Accessed: November 2023].

CAA (January 2022), 'CAP 168: Licensing of Aerodromes'. https://publicapps.caa.co.uk/docs/33/CAP%20168%20Licensing%20of%20Aerodromes%20v12%20c0123%20(004).pdf [Accessed: November 2023].

CAA (June 2019), 'CAP 670: Air Traffic Services Safety Requirements'. https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=9124 [Accessed: November 2023].

CAA (March 2021), 'CAP1616: Airspace change: Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information'. https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8127 [Accessed: November 2023].

CAA (November 2023), 'CAP 032: UK Aeronautical Publication'. https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/ [Accessed: November 2023].

CAA Norway (September 2014), 'Regulations relating to reporting, registration and marking of obstacles to aviation'. [Accessed: November 2023].

CAA Norway (September 2023), 'eAIP'. https://ais.avinor.no/no/AIP/View/127/history-no-NO.html [Accessed: November 2023].

DIO (January 2024), 'MOD Response Letter, MOD Check_Oct 2023'.

HCA (2023), 'Helideck Certificates'. Available online at: UK-N Archives - Helideck Certification Agency Ltd (helidecks.org) [Accessed: November 2023].

ICAO (July 2022), 'Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations'. https://store.icao.int/en/annex-14-aerodromes [Accessed; November 2023].

MCA (April 2021), 'Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response'. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1157005/MGN_654.pdf [Accessed: November 2023].

MCA (November 2021), 'Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response'. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1034158/OREI_SAR_Requirements_v3.pdf [Accessed: November 2023].

MOD (January 2020), 'MOD Obstruction Lighting Guidance'. https://cdn.ymaws.com/www.renewableuk.com/resource/collection/0B792CF1-8B8A-474B-95B6-17886BF724A7/20190002-Windfarm_lighting_review__002_.pdf [Accessed: November 2023].

MOD (November 2023), 'UK Military Aeronautical Publication'. https://www.aidu.mod.uk/aip/aipVolumes.html [Accessed: November 2023].

NATS (October 2012), 'Self-assessment maps'. https://www.nats.aero/services-products/catalogue/n/wind-farms-self-assessment-maps/ [Accessed: November 2023].

NATS (December 2023), 'Technical and Operational Assessment (TOPA) For Arven Offshore Wind Farm Development, NATS ref: SG36514, Issue 2'.

NSTA (November 2023), 'NSTA Offshore Zipped Shapefiles ETR89'. https://opendata-nstauthority.hub.arcgis.com/documents/-nsta-offshore-zipped-shapefiles-etrs89/about [Accessed: November 2023].

Chapter 15 – Shipping and Navigation

International Association of Marine Aids to Navigation and Lighthouse Authorities (2021a), 'Recommendation O-139 the Marking of Man-Made Offshore Structures'. Edition 3.0 (Saint Germaine en Laye, France: International Association of Marine Aids to Navigation and Lighthouse Authorities).

International Association of Marine Aids to Navigation and Lighthouse Authorities (2021b), 'G1162 The Marking of Offshore Man-Made Structures'. Edition 1.0 (Saint Germaine en Laye, France: International Association of Marine Aids to Navigation and Lighthouse Authorities).

International Maritime Organization (1972/77), 'Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) – Annex 3' (London: International Maritime Organization).

International Maritime Organization (1974), 'International Convention for the Safety of Life at Sea' (London: International Maritime Organization).

International Maritime Organization (2018), 'Revised Guidelines for Formal Safety Assessment' (London: International Maritime Organization).

Maritime and Coastguard Agency (2021), 'MGN 654 (Merchant and Fishing) Offshore Renewable Energy Installations (OREI) – Guidance on UK Navigational Practice, Safety and Emergency Response' (Southampton: Maritime and Coastguard Agency).

Maritime and Coastguard Agency (2022), 'Marine Guidance Note 372 Amendment 1 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs (Southampton: Maritime and Coastguard Agency).

Royal Yachting Association (2019), 'The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy' (Southampton: Royal Yachting Association).

United Kingdom Hydrographic Office (2022), 'NP52 Admiralty Sailing Directions North Coast of Scotland Pilot, 11th Edition' (Taunton: United Kingdom Hydrographic Office).

United Nations (1982), 'United Nations Convention on the Law of the Sea'.

Chapter 16 - Marine Archaeology and Cultural Heritage

Bailey, Momber, G., Bell, M., Tizzard, L., Hardy, K., Bicket, A., Tidbury, L., Benjamin, J., and A. Hale (2020), 'Great Britain: The Intertidal and Underwater Archaeology of Britain's Submerged Landscapes', In: Geoff Bailey, Nena Galanidou, Hans Peeters, Hauke Jöns and Moritz Mennenga (eds.) The Archaeology of Europe's Drowned Landscapes. Coastal Research Library, vol 35 (Cham: Springer).

Bicket, A. and Tizzard, L. (2015), 'A review of the submerged prehistory and palaeolandscapes of the British Isles, Proceedings of the Geologists' Association', 126 (6): 643–663.

Chartered Institute for Archaeologists (CIfA) (2014, updated 2020), 'Standards and guidance for historic environment desk-based assessment'. Reading, CIfA.

COWRIE (2007), 'Historic environment guidance for the offshore renewable sector'. (Salisbury: Wessex Archaeology).

Dawson, A, Dawson, S., Bondevik, S., Costa, P. J. M., Hill, J. and. Stewart (2020), 'Reconciling Storegga tsunami sedimentation patterns with modelled wave heights: a discussion from the Shetland Isles field laboratory', Sedimentology 67:1344- 1353.

Dawson, S., Bates, R., Wickham-Jones, C. & Dawson, A. (2017), 'Northern North Sea and Atlantic Northwest approaches', In Nicholas Flemming, Jan Harff, Delminda Moura, Anthony Burgess and Geoffrey Bailey (eds.) Submerged Landscapes of the European Continental Shelf: Quaternary Paleoenvironments (Chichester: John Wiley & Sons Ltd.)

Department for Environment, Food and Rural Affairs (2011), 'UK Marine Policy Statement'. DEFRA.

English Heritage (now Historic England) (2012), 'Ships and Boats: Prehistory to Present - Designation Selection Guide'. English Heritage

English Heritage (2009), 'North Sea Prehistory Research and Management Framework (NSPRMF)', English Heritage.

Gaffney, V. and Fitch, S. (eds.) (2022), 'Europe's Lost Frontier's Vol. 1: Context and Methodology'. (Archaeopress Publishing Ltd).

Gribble, J and Leather, S for EMU Ltd. (2011), 'Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector', commissioned by COWRIE Ltd (project reference GEOARCH-09).

Historic Environment Scotland (2019, updated 2020), 'Designation Policy and Selection Guidance'. Historic Environment Scotland.

Historic Environment Scotland (2019), 'Historic Environment Policy for Scotland'. Historic Environment Scotland.

Joint Nautical Archaeology Policy Committee and The Crown Estate (2006), 'Code of Practice for Seabed Development'. JNAPC.

Marine Scotland (2015), 'Scotland's National Marine Plan: A Single Framework for Managing Our Seas'. Scottish Government.

Oxford Archaeology & George Lambrick Archaeology and Heritage (2008), 'Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy', commissioned by COWRIE Ltd (project reference CIARCH-11-2006);

Parfitt, S. A., Ashton, N. M., Lewis, S. G. *et al*. (2010), 'Early Pleistocene human occupation at the edge of the Boreal zone in Northwest Europe', Nature 466: 299–233.

Plets, R., Dix, J., & Bates, R. (2013), 'Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes' (Swindon: English Heritage Publishing).

Saville, A. and Wickham-Jones, C. (2012), 'Palaeolithic & Mesolithic Panel Report'., https://scarf.scot/national/palaeolithic-mesolithic-panel-report/ [Accessed: November 2023].

Scottish Natural Heritage & Historic Environment Scotland (2018), 'Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland'. V5. Edinburgh.

Shennan, I, Bradley, S. and Edwards, R. (2018), 'Relative sea-level changes and crustal movements in Britain and Ireland since the Last Glacial Maximum'. Journal of Quaternary Science, 188(1), pp 143-159.

The Crown Estate (2014), 'Protocol for Archaeological Discoveries: Offshore Renewables Projects'. Wessex Archaeology Ltd for The Crown Estate.

The Crown Estate (2014), 'Protocol for Archaeological Discoveries: Offshore Renewables Projects (ORPAD)'. The Crown Estate

The Crown Estate (2021), 'Archaeological Written Scheme of Investigation for Offshore Wind Farm Projects. Crown Estate'.

Wessex Archaeology (2008), 'Aircraft crash sites at sea: a scoping study. Archaeological Desk-based Assessment Final Report'. Report ref 66641.02. Prepared for English Heritage. (Salisbury: Wessex Archaeology).

Wessex Archaeology (2011), 'Assessing Boats and Ships 1860-1950' [Accessed: November 2023].

Chapter 17 – Other Marine Users and Infrastructure

Crown Estate Scotland (2023), 'Crown Estate Scotland Data Spatial Hub'. https://crown-estate-scotland-spatial-hub-coregis.hub.arcgis.com/ [Accessed: October 2023].

Crown Estate Scotland (2023), 'INTOG map and project details March 2023'. https://www.crownestatescotland.com/sites/default/files/2023-07/intog-map-and-project-details-march-2023.pdf [Accessed: October 2023].

Department of Energy and Climate Change (2016), 'UK Offshore Energy SEA 3 – Appendix 1H – Other Users and Material Assets'. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/504567/OESEA3_A1h_Other_users.pdf [Accessed: October 2023].

ESB (2023), 'Sealtainn Offshore Wind Farm'. https://www.sealtainnoffshorewind.com/home [Accessed October 2023].

European Subsea Cable Association (ESCA) (2016), 'Guideline No.6: The Proximity of Offshore Renewable Energy Installations & Submarine Cable Infrastructure in UK Waters'. https://www.escaeu.org/download/?Id=123&source=guidelines [Accessed: October 2023].

International Cable Protection Committee (ICPC) (2021), 'ICPC Recommendations'. https://www.iscpc.org/publications/recommendations [Accessed: October 2023].

Marine Institute (2000), 'Assessment of Impact of Offshore Wind Energy Structures on the Marine Environment'. https://oar.marine.ie/handle/10793/579 [Accessed: October 2023].

Marine Scotland (2020), 'Offshore Wind Energy in Scottish Waters: Regional Locational Guidance'. https://www.gov.scot/publications/sectoral-marine-plan-regional-locational-guidance [Accessed: October 2023].

Marine Scotland (2021), 'The Marine Scotland NMPi Maps'. https://marinescotland.atkinsgeospatial.com/nmpi [Accessed: October 2023].

North Sea Transition Authority (2023), 'Offshore Oil and Gas Activity'. https://www.arcgis.com/apps/webappviewer/index.html?id=f4b1ea5802944a55aa4a9df0184205a5 [Accessed: October 2023].

North Sea Midstream Partners (NSMP) (2023), 'SIRGE Pipline'. https://www.nsmp-limited.com/our-assets/sirge-pipeline/ [Accessed: October 2023].

Oil and Gas UK (2015), 'Pipeline Crossing Agreement and Proximity Agreement Pack'. https://oeuk.org.uk/product/pipeline-crossing-agreement-proximity-agreement-pack [Accessed: October 2023].

Scottish Government (2020), 'Sectoral Marine Plan for Offshore Wind Energy'. https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/documents/ [Accessed October 2023].

Scottish Government (2015), 'Scotland's National Marine Plan – Aquaculture'. https://www.gov.scot/publications/scotlands-national-marine-plan/pages/8/ [Accessed: October 2023].

Scottish Government (2020), 'Sectoral marine plan: regional locational guidance – Section 5 North East'. https://www.gov.scot/publications/sectoral-marine-plan-regional-locational-guidance/pages/5/ [Accessed: October 2023].

Sea Fishing Adventurer.com (2024), 'A Guide To the Shetland Islands for Sea Fishing'. https://seafishingadventurer.com/overview-of-shetland-islands/ [Accessed February 2024].

SSE (2022), 'Major milestone reached as first subsea cable installation begins on Shetland HVDC Link'. https://www.sse.com/news-and-views/2022/07/major-milestone-reached-as-first-subsea-cable-installation-begins-on-shetland-hvdc-link/#:~:text=The%20Shetland%20HVDC%20link%20is%20the%20first%20transmission,as%20ensure%20security%20of%20electricity%20supply%20for%20Shetland [Accessed November 2023]

The Crown Estate (2012a), 'Export transmission cables for offshore renewable installations – Principles of cable routeing and spacing'. https://www.thecrownestate.co.uk/media/1781/ei-km-in-pc-cables-export-transmission-cables-for-offshore-renewable-installations.pdf [Accessed: October 2023].

The Crown Estate (2012b), 'TCE Guidance: Submarine cables and offshore renewable energy installation – Proximity study'. https://www.thecrownestate.co.uk/media/1784/submarine-cables-and-offshore-renewable-energy-installations-proximity-study.pdf [Accessed: October 2023].

The UK Department of Trade (DTI) (2004), 'Non-technical summary SEA 5 -Offshore Oil and Gas Licensing'. https://assets.publishing.service.gov.uk/media/5a7b3ed6ed915d429748dccb/SEA5_Nontechnical_Summary.pdf [Accessed: October 2023].

University of the Highlands and Islands -Shetland (2023), 'Aquaculture'. https://www.shetland.uhi.ac.uk/research/aquaculture/ [Accessed: October 2023].

Chapter 18 – Socioeconomics, Tourism and Recreation

Arven Offshore Wind Farm (2023), 'Supply Chain Development Statement (Arven and Arven South)' October 2023. ScotWind leasing round | Crown Estate Scotland [Accessed February 2024]

Department of Business, Energy and Industrial Strategy (2020), 'Industrial Strategy: Offshore Wind Sector Deal'. https://assets.publishing.service.gov.uk/media/5c9e235740f0b625e647be07/BEIS_Offshore_Wind_Single_Pages_web_optimised.pdf [Accessed November 2023]

HM Treasury (2022), 'Green Book – Central Government Guidance on Appraisal and Evaluation'. https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government/the-green-book-2020 [Accessed November 2023]

Marine Directorate (2022a), 'Defining 'local area' for assessing impact of offshore renewables and other marine developments: guidance principles'. https://www.gov.scot/publications/defining-local-area-assessingimpact-offshore-renewables-marine-developments-guidance-principles/ [Accessed November 2023]

Marine Directorate (2022b), 'General Advice for Socioeconomic Impact Assessment: Marine Analytical Unit'. https://marine.gov.scot/sites/default/files/appendix_i_-_consultation_representations_and_advice_6.pdf Page 32 [Accessed November 2023]

Office of National Statistics (2023), 'Annual Population Survey'. https://www.nomisweb.co.uk/query/construct/summary.asp?mode=construct&version=0&dataset=17 [Accessed November 2023]

Scottish Government (2022a), 'Public Perceptions of Offshore Wind farm Developments in Scotland'. https://www.gov.scot/publications/public-perceptions-offshore-wind-farm-developments-scotland/ [Accessed October 2023]

Scottish Government (2022b), 'Environmental Impact Assessment – EIA'. https://www.mygov.scot/eia#:~:text=Environmental%20Impact%20Assessment%20(EIA)%20is,reduce%20or%20offset%20those%20effects. [Accessed October 2023]

VisitScotland (2020), 'Shetland Islands Visitor Survey 2019'. https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-insights/shetland-islands-visitor-survey-2019.pdf [Accessed November 2023]

White Consultants (2020) Review and Update of Seascape and Visual Buffer study for Offshore Wind farms. https://assets.publishing.service.gov.uk/media/5ef9a3abd3bf7f769a4e7742/White_Consultants_2020_Seascape_and_visual_buffer_study_for_offshore_wind_farms.pdf [Accessed December 2023].

Chapter 19 – Climate Change

British Standard Institute (2022), 'PAS 2080. Carbon Management for Infrastructure Verification'.

Circular Ecology (2024), 'Inventory of Carbon and Energy Database'. https://circularecology.com/embodied-carbon-footprint-database.html [Accessed February 2024].

Construction Leadership Council (2019), 'Guidance Document for PAS 2080'. https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/06/Guidance-Document-for-PAS2080_vFinal.pdf [Accessed February 2024].

HM Government (2012), 'Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal'. https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal [Accessed February 2024].

HM Government (2022), 'Greenhouse gas reporting: conversion factors 2022'. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022 [Accessed February 2024].

HM Government (BEIS) (2023), 'Final UK greenhouse gas emissions national statistics: 1990 to 2021; Final estimates of UK territorial greenhouse gas emissions. https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2021 [Accessed February 2024].

IEMA (2020), 'Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation'. [Accessed November 2023].

IEMA (2022), 'Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance'. https://www.iema.net/preview-document/assessing-greenhouse-gas-emissions-and-evaluating-their-significance [Accessed November 2023].

Met Office (2016), 'Northern Scotland: climate'. https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/northern-scotland_-climate---met-office.pdf [Accessed November 2023].

Institute of Civil Engineers (2023), 'Guidance Document for PAS 2080'. https://www.ice.org.uk/media/vm0nwehp/2023-03-29-pas_2080_guidance_document_april_2023.pdf [Accessed November 2023].

M. Becerra, M. Long, W. Schulz, R. Thottappillil (2018), 'On the estimation of the lightning incidence to offshore wind farms'. Electric Power Systems Research, 157: 211-226. https://www.sciencedirect.com/science/article/abs/pii/S0378779617304790 [Accessed November 2023].

Met Office (2018), 'UKCP18 Guidance: Caveats and limitations'. https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-guidance---caveats-and-limitations.pdf [Accessed November 2023].

Met Office (2023), 'UK Climate Averages: Lerwick'. https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gfxnj5fx4 [Accessed November 2023].

R. Vautard, F. Thais, I. Tobin, F. M. Bréon, J. G. Devezeaux de Lavergne, A. Colette, P. You, P. M. Ruti (2014), 'Regional climate model simulations indicate limited climatic impacts by operational and planned European wind farms' Nature Communications, 5/3196. https://www.nature.com/articles/ncomms4196 [Accessed November 2023].

S. Susini, M. Menendez, P. Eguia J. M. Blanco (2022), 'Climate Change Impact on the Offshore Wind Energy Over the North Sea and the Irish Sea' Frontiers in Energy Research, 10. https://www.frontiersin.org/articles/10.3389/fenrg.2022.881146/full [Accessed November 2023].

Scottish Government (2022), 'Adaptation to climate change – Climate change'. https://www.gov.scot/policies/climate-change/climate-change-adaptation/ [Accessed November 2023].

Scottish Government (2023), 'Update on Scotland's renewables and wind power potential'. https://www.gov.scot/publications/renewables-and-wind-power-update-to-scottish-affairs-committee/ [Accessed February 2024].

Appendix A – Commitments Register

Appendix A - Commitment Register

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
C-1	Development of and adherence to Cable Plan (CaP). The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring.	X	X	X	X	X			X		X	X	X			X			Required by Section 36 and Marine Licence consent conditions.
C-2	Development of and adherence to a Development Specification and Layout Plan (DSLP). The DSLP will confirm the layout and design parameters of the Project.	X						X			X					X			Required by Section 36 and Marine Licence consent conditions.
C-3	Development of and adherence to a Fisheries Management and Mitigation Strategy (FMMS). The FMMS will set out the means of ongoing fisheries liaison through construction and operation and maintenance phases of the Project and detail any mitigation measures to be put in place to limit effects on commercial fisheries activity.								X		X					X	X	X	Required by Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
C-4	Development of and adherence to a Construction Method Statement (CMS). The CMS will confirm construction methods and the roles and responsibilities of parties engaged in construction. It will detail any construction-related mitigation measures.	X	X										X		X	X			Required by Section 36 and Marine Licence consent conditions.
C-5	Preparation of a Design Statement (DS). The DS will present representative wind farm visualisations from key viewpoints, based on the final layout and design specifications in the DSLP.							X								X			Required by Section 36 and Marine Licence consent conditions.
C-6	Development of and adherence to an Environmental Management Plan (EMP). The EMP will set out mitigation measures and procedures relevant to environmental management, including but not limited to the following topics: Chemical usage, invasive non-native marine species, dropped objects, pollution prevention and contingency planning, and waste management.		X	X	X	X							X		X	X	X	X	Required by Section 36 and Marine Licence consent conditions.
C-7	Appointment of a Company Fisheries Liaison Officer (CFLO). The CFLO will								X							X	X	X	Required by Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
	support ongoing liaison and ensure clear communication between the Project and commercial fisheries.																		
C-8	Appointment of an Environmental Clerk of Works (ECoW). The ECoW will monitor compliance of the Project with granted consents.				X	X	X									X			Required by Section 36 and Marine Licence consent conditions.
C-9	Development of and adherence to a Marine Pollution Contingency Plan (MPCP). The MPCP will identify potential sources of pollution and associated spill response and reporting procedures.		X	X	X	X					X		X			X	X	X	Required by Section 36 and Marine Licence consent conditions.
C-10	Development of and adherence to a Navigational Safety Plan (NSP). The NSP will describe measures put in place by the Project related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Project activity to other sea users (e.g. via Notice to Mariners).								X		X		X	X		X	X	X	Required by Section 36 and Marine Licence consent conditions.
C-11	Development of and adherence to a Piling Strategy				X	X										X			Required by Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
	(PS) (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g. soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.																		
C-12	Development of and adherence to a Project Environmental Monitoring Programme (PEMP), which will set out commitments to environmental monitoring in pre-, during and post-construction Project phases.		X		X	X	X		X						X	X	X	X	Required by Section 36 and Marine Licence consent conditions.
C-13	Development of and adherence to a Vessel Management Plan (VMP). The VMP will confirm the types and numbers of vessels that will be engaged on the Project, and consider vessel coordination including indicative transit route planning.		X			X	X				X			X		X	X		Required by Section 36 and Marine Licence consent conditions.
C-14	Development of and adherence to a Decommissioning Programme (DP). The DP will outline	X	X	X	X	X	X	X	X	X	X	X	X		X			X	Required by Section 36 and Marine Licence consent conditions and

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
	measures for the decommissioning of the Project.																		Section 105 of the Energy Act 2004 (as amended).
C-15	Development of and adherence to a Construction Programme (CoP). The CoP will confirm the timing and duration of the main Project construction activities.			X	X		X		X		X		X			X			Required by Section 36 and Marine Licence consent conditions.
C-16	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.						X		X	X	X		X	X		X	X		Required by Section 36 and Marine Licence consent conditions.
C-17	Development of and adherence to an Operation and Maintenance Programme (OMP). The OMP will describe operation and maintenance activities and provide an indicative schedule for the undertaking of these.	X	X	X					X		X	X					X		Required by Section 36 and Marine Licence consent conditions.
C-18	Development of and adherence to an Emergency Response Cooperation Plan (ERCoP). The ERCoP will be prepared in line with MCA guidance and confirms what measures the Project has in									X	X		X			X	X	X	Required by Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
	place to support any emergency response.																		
C-19	Development of and adherence to a Written Scheme of Archaeological Investigation (WSI). The Marine WSI will include the implementation of a Protocol for Archaeological Discoveries (PAD) in accordance with 'Protocol for Archaeological Discoveries: Offshore Renewables Projects' (The Crown Estate, 2014).											X				X	X	X	Required by Section 36 and Marine Licence consent conditions.
C-20	Scour protection where there is the potential for scour to develop around infrastructure (foundations, moorings and cables).	X	X	X								X				X	X	X	Detailed in the CMS and CaP, required under Section 36 and Marine Licence consent conditions.
C-21	Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the Project and fishing activities (e.g. FLOWW, 2014; 2015).								X							X	X	X	Detailed in the FMMS, required under Section 36 and Marine Licence consent conditions.
C-22	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will								X		X		X	X		X	X	X	Detailed in the NSP, required under Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
	be given via Notices to Mariners and Kingfisher Bulletins.																		
C-23	Participation in any fisheries working group to assist with liaison between the Project and the fishing community.								X							X	X	X	Detailed in the FMMS, required under Section 36 and Marine Licence consent conditions.
C-24	Application for and use of Safety Zones of up to 500m during construction, maintenance and decommissioning phases. Where appropriate, guard vessels will also be used to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.								X		X		X			X	X	X	Detailed in the NSP, required under Section 36 and Marine Licence consent conditions. Application for Safety Zones will be made to MS-LOT ahead of construction.
C-26	Compliance of all Project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea										X					X	X	X	Consultation with NLB to confirm requirements for marking and lighting based on final layout (as part of the Lighting and Marking

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
	(COLREGs) (IMO, 1974) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974).																		Plan which is a condition of the Section 36 and Marine Licence)
C-27	Marine coordination and communication to manage Project vessel movements.										X		X	X		X	X	X	Detailed in the VMP, required under Section 36 and Marine Licence consent conditions.
C-28	Any objects dropped on the seabed during works associated with the Project will be reported and objects will be recovered where they pose a hazard to other marine users and where recovery is possible.								X		X		X			X	X	X	Dropped objects procedure within the EMP, required under Section 36 and Marine Licence consent conditions.
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment and detailed within the CaP.	X	X	X	X				X										Detailed in the CaP, required under Section 36 and Marine Licence consent conditions.
C-32	Suitable implementation and monitoring of cable protection (via burial, or external protection where adequate burial depth as identified via risk assessment is not feasible), as detailed within the CaP.	X	X	X					X										Detailed in the CaP, required under Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
C-33	Compliance with Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021) and its annexes where applicable. Also MGN 543 Search and Rescue (SAR) annex 5 (MCA, 2018).									X	X					X	X	X	SAR checklist and NSP, required under Section 36 and Marine Licence consent conditions.
C-34	Appropriate marking of the Project on Admiralty and aeronautical charts. This will involve provision of the positions and heights of structures to the UKHO, CAA, MoD and DGC.								X	X	X		X			X	X		Detailed in the NSP and LMP and reflected in specific marine and aeronautical charting requirements under Section 36 and Marine Licence consent conditions.
C-35	The construction area will be buoyed, as described in the NSP. Buoyage will be defined in consultation with the NLB.										X					X			Detailed in the NSP, required under Section 36 and Marine Licence consent conditions.
C-36	Marine navigation marking and lighting of the Project, as described in the LMP, will be defined in agreement with NLB and in line with International Association of Lighthouse Authorities (IALA) Recommendation O-139 (IALA, 2013).										X					X	X	X	Detailed in the LMP, required under Section 36 and Marine Licence consent conditions.
C-37	Seabed preparation, installation activities and installed infrastructure will avoid any identified seabed											X				X	X	X	Detailed in the WSI, required under Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
	heritage assets and anthropogenic geophysical anomalies through the implementation of Archaeological Exclusion Zones (AEZs) and described in the WSI.																		
C-38	Aviation lighting and marking, as described in the LMP, will be installed in accordance with Article 223 of Civil Aviation Publication (CAP) 393, the UK Air Navigation Order (ANO) 2016 which sets out the mandatory requirements to be followed for lighting of offshore Wind Turbine Generators.									X						X	X	X	Detailed in the LMP, required under Section 36 and Marine Licence consent conditions.
C-39	The layout of the Project, as presented in the DSLP, will be finalised in discussion with the MCA and the NLB in order to ensure the specific turbine layout is compatible with potential Search and Rescue activity.									X	X					X			Detailed in the DSLP, required under Section 36 and Marine Licence consent conditions.
C-40	Failures to Project lighting and marking will be appropriately reported and rectified as soon as practicable. Interim hazard warnings will be put in place as required.									X	X					X	X	X	Detailed in the LMP, required under Section 36 and Marine Licence consent conditions.

Reference	Mitigation Commitment	Marine Geology, Oceanography and Physical Processes	Marine Water and Sediment Quality	Benthic, Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Marine Mammals and Other Megafauna	Offshore Ornithology	Seascape, Landscape and Visual	Commercial Fisheries	Aviation and Radar	Shipping and Navigation	Offshore Archaeology and Cultural Heritage	Other Marine Users and Infrastructure	Socioeconomics, Tourism and Recreation	Climate Change and Greenhouse Gas	Construction	Operation and Maintenance	Decommissioning	Where the commitment is secured
C-41	Guard Vessel(s) as required by risk assessment at the time of planning the activity										X					X	X	X	
C-43	There will be a minimum blade tip clearance (air draft height) of at least 22 m above Mean High Water Spring (MHWS).						X	X		X	X		X			X	X	X	Detailed in the Construction Method Statement

Appendix B – Impacts Register

Appendix B Impact Register

1 Marine Geology, Oceanography and Physical Process

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Increases in suspended sediment concentrations (SSCs) and changes to seabed levels	Construction and Decommissioning	C-1; C-4, C-14; C-29; C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Temporary elevations in SSCs due to construction (i.e., cable installation) activities. This could in turn result in changes to the underlying seabed/coastal bed levels, through deposition of the suspended material and changes to the surficial sediment type. Increases in SSC and associated deposition may have indirect, adverse impacts upon other receptor groups including Benthic, Subtidal and Intertidal Ecology: Chapter 8, Fish Ecology: Chapter 9, Marine Mammals and Ecology: Chapter 10 and Commercial Fisheries: Chapter 13. the proposed assessment is the modelling and monitoring ensuring SSC and accretion remains within a certain threshold.
Potential impacts to seabed morphology (sandbanks and notable bathymetric depressions).	Construction and Decommissioning	C-1, C-4; C-14, C-29; C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Activities such as seabed preparation, sand wave levelling and cable trenching have the potential to directly disturb the seabed morphology. This disturbance may have adverse impacts on other receptor groups including Benthic, Subtidal and Intertidal Ecology: Chapter 8, Fish and Ecology: Chapter 9, and Commercial Fisheries: Chapter 13. Decommissioning activities relating to the removal of infrastructure (if required) have the potential to directly disturb the local seabed morphology. Decommissioning activities relating to the removal of infrastructure (if required) have the potential to directly disturb the local seabed morphology. Likely to be localised but disturbance may have adverse impacts on other receptor groups.
Modifications to littoral transport and coastal behaviour (erosion), including at Landfall.	Operation and Maintenance	C-1, C-4, C-14, C-29, C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Where the Offshore Export Cable makes Landfall, it must transition through the Intertidal Areas and coastal zones. The methods identified for removing or decommissioning the cable and/or Cable Protection aspects may physically disturb the local morphology. The methods available for installing cables in such environments may physically disturb or disrupt the coastal morphology to differing degrees depending on the construction methods employed and any structures installed. At the time of construction, any disturbance is likely to be localised to the Landfall site. This disturbance may have adverse impacts on other receptor groups including Benthic, Subtidal and Intertidal Ecology (Chapter 8).

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Seabed Scouring	Operation and Maintenance	C-1, C-17, C-20, C-29, C32	Possible likely significant effect without secondary mitigation - **Scoped In**	The wind farm infrastructure has the potential to cause localised seabed scouring, resulting in bathymetric changes and localised alterations to sediment transport patterns. This is likely to occur both around Foundations for offshore electrical platform(s) as well as around anchors and clump weights that may be part of floating WTG infrastructure. Scour is likely to occur both around foundations for Offshore Substation (OSS)s as well as around anchors and clump weights that may be part of floating WTG infrastructure.
Modifications to the tidal regime, and associated impacts to morphological features.	Operation and Maintenance	C-2, C-17	Possible likely significant effect without secondary mitigation - **Scoped In**	The interaction between the planned infrastructure, for example the WTGs, Cable Protection or cable crossings, and the baseline metocean regime (waves; tides) may result in localised changes to tidal current speeds, wave energy and turbulence. These changes may, in turn, impact on adjacent physical features, both offshore and along the coast. It is considered that the impacts potentially introduced by floating offshore structures will be greatly reduced relative to any resulting from the presence of fixed offshore structures, due to the vertical cross section of infrastructure in the water column being much less. Impact assessments for previous offshore wind developments, based on fixed turbine Foundations, have demonstrated that there are no significant impacts on waves and tidal regime (Repsol and EDP Renewables, 2013; Moray Offshore Renewables Limited (MORL), 2014). In combination with the generally low tidal currents in the area (Figure 6.4), as well as distance offshore (30 km to Arven South and 39.3 km Arven) and water depths (110 to 160 m), these impacts are considered unlikely to significantly impact adjacent morphological features or the coast and are therefore proposed to be scoped out of further assessment.
Potential impacts to seabed morphology	Operation and Maintenance	C-1, C-17, C-20, C-29 C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Arven will be a floating Offshore Wind Farm (OWF). There is the potential for the introduction of localised seabed abrasion associated with wind farm infrastructure that moves, for example anchor or mooring chains, under the influence of waves, currents, and movement of the turbines (Maxwell et al.., 2022). This could result in localised change to seabed morphology. In addition, the Offshore ECC may cross parts of Pobie Bank and the West Unst Basin. The presence of the cable and any Cable Protection in this offshore area has the potential to change the form and function of the seabed locally, potentially impacting on the designated features of the NC MPA.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Construction impacts on the wave and tidal regime	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	Any potential impacts of the array infrastructure will increase/ decrease incrementally throughout the construction/ decommissioning process, respectively such that the greatest potential impact will occur during the O&M phase. As such, these impacts are scoped out from further assessment.
Impacts on seabed morphology due to indentations on the seabed from installation vessels	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	Any vessels which rely upon jacket-legs or anchors to remain in position during construction works have the potential to impact the seabed on a scale proportional to the dimensions and drag (if applicable) of the item placed on the seabed. The localised spatial scale and temporary nature of the impact, given that over time any indentation will likely infill. As such, these impacts are scoped out from further assessment.
Modifications to the wave regime, and associated impacts to morphological features	Operation and Maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	The interaction between the planned infrastructure, for example the WTGs, cable protection or cable crossings, and the baseline metocean regime, may result in localised changes to wave energy and turbulence. These changes may, in turn, impact on adjacent physical features, both offshore and along the coast. Impact assessments for previous offshore wind developments, based on fixed turbine foundations, have demonstrated that there are no significant impacts on the wave regime (Repsol and EDP Renewables, 2013; MORL, 2014). Due to the distance offshore (circa 30 km at its closest point) and water depths (110 m to 160 m), any changes to the wave regime are considered unlikely to significantly impact adjacent seabed features or the coast and are therefore scoped out of further assessment.
Modifications to stratification and frontal features.	Operation and Maintenance Phase	N/A	No likely significant affect at Scoping - **Scoped Out**	Interactions between planned infrastructure and the baseline metocean regime (waves, tides) may result in localised changes to tidal currents speeds, wave energy and turbulence. These changes result in the generation of localised turbulent wakes (Dorrell et al.., 2022). However, floating Offshore Wind Farm in deeper water are expected to be less disruptive to current and wave regimes (and hence seasonal stratification) than fixed turbines in shallower waters (Farr et al.., 2021). The frontal feature in the region is located between the Array Areas and the coastline (Figure 6.7). Due to both the project design (floating WTG), existing hydrodynamics and the front location, impacts upon the formation and duration of the front are not anticipated.

2 Marine Sediment and Water Quality

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Deterioration in water quality due to suspension of sediments.	Construction and Decommissioning	C-1, C-2, C-14, C-29	Possible likely significant effect without secondary mitigation - **Scoped In**	Temporary elevations in SSCs arising from construction activities (such as Foundation installation or cable laying) may result in adverse Effects on marine water quality. This reduction in water quality may be indicated by changes in levels of nutrients and dissolved oxygen, a reduction in water clarity, and changes in primary production levels. Sampling and modelling will monitor the water quality and ensure it is within reasonable limits.
Deterioration in water clarity	Construction and Decommissioning	C-1aP, C-2, C-12, C-14, C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	To undertake trenchless cable installation techniques (such as Horizontal Directional Drilling (HDD)) which may be required at Landfall, drilling mud, such as bentonite (or another inert mud) may be required. This may result in the release of drilling mud at the punch out point. In MW&SQ terms, the primary issue relating to bentonite release comes from potential increase in SSC in the water column, and potential reduction in bacterial mortality. Sampling and modelling will monitor the water quality and ensure it is within reasonable limits.
Release of sediment-bound contaminants from disturbed sediments.	Construction and Decommissioning	C-1aP, C-2, C-12, C-14, C-29, C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Temporary elevations in SSC from construction activities may lead to release of sediment-bound contaminants into the water column. This temporary re-suspension and redistribution of existing contaminant may have adverse Effects on water quality. Sampling and modelling will monitor the water quality and ensure it is within reasonable limits.
Deterioration in status of WFD coastal waterbodies.	Construction and Decommissioning	C-1, C-6, C-12, C-14	Possible likely significant effect without secondary mitigation - **Scoped In**	Deterioration in status of nearby coastal and transitional waterbodies. A WFD compliance assessment will be produced as part of the EIA to assess potential impacts to WFD waterbodies and protected areas. Given the boundaries of WFD waterbodies only extend to one nautical mile from the low water mark, it is anticipated that potential impacts would be associated with works for the Offshore Export Cable(s) and Landfall
Deterioration in water quality due to the suspension of sediments from O&M activities.	Operation and Maintenance Phase	C-1, C-2, C-12, C-17, C-20, C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Should a section of the Offshore Export Cable become exposed or damaged, there would be a requirement for reburial or replacement. Cable reburial (or replacement) would be undertaken using similar techniques to those which were used to originally install the cables.
Deterioration in status of WFD coastal waterbodies from O&M activities.	Operation and Maintenance Phase	C-1,C-6, C-12 , C-17	Possible likely significant effect without	Activities associated with O&M have potential to result in a deterioration in status of nearby coastal and transitional waterbodies. Given the boundaries of WFD waterbodies only extend to one nm from the low water mark, it is anticipated that potential impacts would be associated with works for the Offshore Export Cable(s). A

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
			secondary mitigation - **Scoped In**	WFD compliance assessment will be produced as part of the EIA to assess potential impacts to WFD waterbodies and protected areas.
Accidental release or spills of materials or chemicals.	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	There is potential for accidental spills or release of materials/chemicals during maintenance works from associated vessels during the O&M phase. However, impacts are anticipated as being short-lived and highly localised. In the event of an accidental spillage, hydrocarbons would be rapidly dispersed or diluted. Moreover, vessels associated with the proposed development will be required to comply with strict environmental controls set out in the EMP, which will minimise risk and set out provisions for responses to spills during O&M activities. Due to the implementation measures and small quantities of chemical and hydrocarbons, it is proposed to scope this impact out of further consideration within the EIA.
Deterioration in Bathing Water quality .	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	The activities associated with the construction and decommissioning of the proposed development have the potential to result in deterioration to Bathing Water classifications. For example, increased turbidity resulting from sediment plumes may reduce bacterial mortality, impacting the Bathing Water classifications for that bathing season. However, there are no designated bathing waters within the study area, allowing this to be scoped out of the assessment.
Deterioration in water quality due to re-suspension and deposit of sediments from scour.	Operation and Maintenance Phase	N/A	No likely significant affect at Scoping - **Scoped Out**	There is potential for elevated SSC resulting from scour around infrastructure, including Ffoundations and cable protection. Considering that the volume of suspended sediment released during operation via scour would be far lower than that released during construction or repair activities, it is proposed for this impact to be scoped out from further consideration within the EIA. Moreover, the Eeffects will be highly localised and associated volumes of mobile sediments are considered within the range of natural variability.
Changes in water and sediment quality associated with the cleaning of infrastructure.	Operation and Maintenance Phase	N/A	No likely significant affect at Scoping - **Scoped Out**	Some routine maintenance activities on infrastructure (such as removal/cleaning of biofouling) have potential to result in reduced water and sediment quality in the immediate vicinity of the activity. These operational cleaning activities may release some substances, such as anti-fouling paint into the marine environment. Any potential impacts from these activities are expected to be highly localised, small scale, temporary and short-lived. Risks will be managed through the embedded commitment measures presented.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Accidental release or spills of materials or chemicals.	Operation and Maintenance Phase	N/A	No likely significant affect at Scoping - **Scoped Out**	There is potential for accidental spills or release of materials/chemicals during maintenance works from associated vessels during the O&M phase. However, impacts are anticipated as being short-lived and highly localised. In the event of an accidental spillage, hydrocarbons would be rapidly dispersed or diluted. Moreover, vessels associated with the proposed development will be required to comply with strict environmental controls set out in the EMP, which will minimise risk and set out provisions for responses to spills during O&M activities. Due to the implementation measures and small quantities of chemical and hydrocarbons, it is proposed to scope this impact out of further consideration within the EIA.

3 Benthic, Subtidal and Intertidal Ecology

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Increases in SSC and changes to seabed levels	Construction and Decommissioning	C-1; C-14; C-15; C-29; C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Temporary elevations in SSCs due to construction (i.e., cable installation) activities. This could in turn result in changes to the underlying seabed/coastal bed levels, through deposition of the suspended material and changes to the surficial sediment type. This assessment will be informed by the worst-case parameters for cable and foundation installation activities during the construction phase, and decommissioning activities. Sediment plume modelling will be undertaken and used to inform the maximum plume extents and sediment deposition.
Temporary habitat disturbance	Construction and Decommissioning	C-1; C-6; C-14; C-15; C-29; C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	There is potential for temporary, direct habitat disturbance during construction activities in the Array Areas and along the Offshore ECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. This assessment will be informed by the worst case parameters for seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring.
Direct and indirect disturbance leading to the release of sediment contaminants	Construction and Decommissioning	C-1; C-6; C-9; C-14; C-15	Possible likely significant effect without secondary mitigation - **Scoped In**	Seabed disturbance during construction, operation and maintenance and decommissioning phases could lead to the mobilisation of existing sediment contaminants that could have an impact on the benthos. Effects on benthic subtidal and intertidal ecology because of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments. This assessment will be informed by the worst-case parameters for sediment disturbance during the construction and decommissioning phases. The assessment will be informed by site specific surveys undertaken to review intertidal and subtidal sediment contamination across the site. These are detailed in Chapter 7: Marine Water and Sediment Quality.
Permanent and/or long-term habitat loss/alternation due to the removal of infrastructure	Construction and Decommissioning	C-14	Possible likely significant effect without secondary mitigation - **Scoped In**	Following the decommissioning of proposed development there is potential for long-term habitat loss or alteration directly associated with the removal of infrastructure. This assessment will be informed by the worst-case parameters for the physical presence of infrastructure on the seabed.
Increased risk of introduction and/or spread of Invasive Non-Native Species (INNS)	Construction and Decommissioning	C-6; C-14; C-15;	Possible likely significant effect without secondary mitigation - **Scoped In**	Increased risk of introduction or spread of Marine INNS due to increased vessel movements during construction (e.g. ballast water) may facilitate the spread of non-native species and may subsequently impact biodiversity and the benthic ecology of the area. Invasive non-native plant and animal species (INNS) can be spread inadvertently in soil which is moved around the construction site and on

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
				machinery etc. which is moved between construction sites, which may result in an offence under wildlife legislation and negative impacts on the ecosystems to which the species are transferred. This assessment will be informed by the worst-case parameters for the installed infrastructure during the construction and decommissioning phase.
Direct and indirect disturbance leading to the release of sediment contaminants	Operation and Maintenance Phase	C-1; C-6; C-9; C-17	Possible likely significant effect without secondary mitigation - **Scoped In**	Seabed disturbance during construction, operation and maintenance and decommissioning phases could lead to the mobilisation of existing sediment contaminants that could have an impact on the benthos. Effects on benthic subtidal and intertidal ecology because of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments. This assessment will be informed by the worst-case parameters for sediment disturbance during the construction and decommissioning phases. The assessment will be informed by site specific surveys undertaken to review intertidal and subtidal sediment contamination across the site. These are detailed in Chapter 7: Marine Water and Sediment Quality.
Permanent and/or long-term habitat loss/alteration due to the addition of infrastructure to the area	Operation and Maintenance Phase	C-17	Possible likely significant effect without secondary mitigation - **Scoped In**	Following the construction of the proposed development there is potential for long-term habitat loss or alteration directly associated with the presence of, for example, WTG foundations, scour and cable protection. This assessment will be informed by the worst-case parameters for the physical presence of infrastructure on the seabed.
Temporary habitat disturbance	Operation and Maintenance Phase	C-1; C-6; C-17	Possible likely significant effect without secondary mitigation - **Scoped In**	There is the potential for direct habitat disturbance of the seabed during planned and unplanned maintenance through (e.g., the use of jack up vessels or cable repair or replacement). This assessment will be informed by the worst case parameters for the use of jack up vessels or cable repair or replacement.
Colonisation of hard substrates	Operation and Maintenance Phase	C-17	Possible likely significant effect without secondary mitigation - **Scoped In**	Man-made substructures such as WTG foundations and any associated scour/cable protection on the seabed are expected to be colonised by marine organisms. This colonisation is expected to then result in an increase in local biodiversity and alterations to the near field benthic ecology of the area. This assessment will be informed by the worst-case parameters for the introduced man-made substructures which are expected to be colonised by marine organisms during the operation and maintenance phase.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Changes in physical processes resulting from the presence of the proposed development 's subsea infrastructure e.g., scour effects, changes in wave/ tidal current regimes and resulting effects on sediment transport	Operation and Maintenance Phase	C-17; C-29; C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	With embedded mitigation measures implemented it is unlikely there will be significant impacts to benthic ecology features from changes in physical processes as impact will be spatially and temporally minimal. Physical processes modelling of other OWF projects has predicted small, local impacts on benthic communities from disturbances of this nature. However, this impact will be fully assessed. This assessment will be informed by the worst-case parameters for the physical presence of infrastructure on the seabed for changes in physical processes, determined by modelling and assessment. The subsequent impact on benthic ecology features will be assessed.
Electromagnetic Field from buried Operational Cables	Operation and Maintenance Phase	C-1; C-17; C-29; C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	EMF may impact sensitive species, including elasmobranchs, teleost fish (i.e., flat fish, salmonids and gadoids) and crustaceans (e.g. brown crab) by altering foraging or migratory behaviour .behaviour. The magnitude of this impact will depend in part on the project design and the burial and cable protection measures which are utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column. This assessment will be informed by the worst-case parameters for the presence of cables on the sea floor and the burial and cable protection measures utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column. It is acknowledged that there is limited, but emerging research on EMF impacts on benthic ecology, especially for dynamic cables. The impact assessment will draw on the latest relevant available literature on this impact.
Accidental pollution during construction or decommissioning activity and during the operational and maintenance phase	Construction and Operation and Maintenance and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	Chemical and oil inventories on vessels working during construction and decommissioning stages will be small in size. In the event of an accidental chemical or oil spill, hydrocarbons would rapidly be dispersed or diluted. As well as this, all vessels on the Offshore Proposed Development will be required to comply with strict environmental controls set out in the EMP which will minimise the risk and set out provisions for responding to spills during construction or decommissioning. Due to the implementation of control measures and small quantities of hydrocarbons and chemicals it is proposed to scope this impact out of further consideration within the EIA.

4 Fish and Shellfish Ecology

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Increases in SSC and changes to seabed levels	Construction and Decommissioning	C-1; C-6; C-8; C-11; C-14; C-15	Possible likely significant effect without secondary mitigation - **Scoped In**	Temporary elevations in SSCs have the potential to occur during construction (i.e., cable and foundation installation) activities and decommissioning activities. This could in turn lead to smothering of slow moving or sessile species and also localised changes in sediment type which may potentially impact seabed dependent species (e.g., sandeel and herring). This assessment will be informed by the worst-case parameters for cable and foundation installation activities during the construction phase, and decommissioning activities. Sediment plume modelling will be undertaken and used to inform the maximum plume extents and sediment deposition.
Temporary habitat disturbance	Construction and Decommissioning	C-1; C-8; C-11; C-14; C-15	Possible likely significant effect without secondary mitigation - **Scoped In**	There is potential for temporary, direct habitat disturbance during construction activities in the Array Areas and along the Offshore ECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. Temporary habitat disturbance has the potential to negatively impact species that are dependent on the seabed for some or all of their life cycle. This assessment will be informed by the worst case parameters for seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring.
Direct and indirect disturbance leading to the release of sediment contaminants	Construction and Decommissioning	C-1; C-6; C-8; C-9; C-14; C-15	Possible likely significant effect without secondary mitigation - **Scoped In**	Seabed disturbance during construction could lead to the mobilisation of existing sediment contaminants that could have an impact on fish and shellfish receptors. Effects on fish and shellfish ecology as a result of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments. This assessment will be informed by the worst-case parameters for sediment disturbance during the construction and decommissioning phases. The assessment will be informed by site specific surveys undertaken to review intertidal and subtidal sediment contamination across the site. These are detailed in Chapter 7: Marine Water and Sediment Quality.
Mortality, Injury, behavioral impacts, and auditory masking arising from noise and vibration	Construction and Decommissioning	C-1; C-8; C-11; C-12; C-14; C-15	Possible likely significant effect without secondary mitigation - **Scoped In**	Potential effects from construction activities may arise from noise and vibrations from pile-driving for the installation of Offshore Substation Platform foundations (with the potential for anchor/mooring piling for floating foundations). Cable laying, dredging and vessel movements also have the potential to result in underwater noise. Noise from piling has the potential to cause significant impacts to fish and shellfish species ranging from lethal trauma to behavioural changes in susceptible fish species. Underwater noise modelling will be undertaken as part of the EIA in line with worst case scenarios. This assessment will be informed by the worst-case parameters for noise and vibrations from pile-driving for the installation of Offshore Substation Platform foundations (with the potential for

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
				anchor/mooring piling for floating foundations), cable laying, dredging and vessel movements. Underwater noise modelling will be undertaken to inform this assessment.
Permanent and/or long-term habitat loss/alteration due to the addition of infrastructure to the area	Operation and Maintenance	C-1; C-8; C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	Potential effects during the operational phase will mostly result from the physical presence of infrastructure (i.e., anchors, foundations, scour and cable protection above the seabed) which will result in long-term habitat loss. For floating foundations, abrasion from the mooring lines /anchor chains may also result in long-term habitat disturbance and will be considered. These effects have the potential for impacts on substrate dependent fish and shellfish, in particular those that have substrate specific spawning behaviours (e.g., sandeel, herring), or those with designated conservation status. Furthermore, the introduction of infrastructure has the potential to alter the fish and shellfish assemblage ecology within the area due to disturbance and/or removal of feeding grounds for these species and the subsequent changes in prey availability. Impacts on sensitive fish and shellfish species will be considered in terms of long-term loss of spawning habitats and impacts on species of conservation importance. The area of habitat loss will be defined using a worst-case scenario to determine the maximum loss of seabed, and the potential loss herring and sandeel spawning grounds. It is considered that there are sufficient existing data to inform this assessment, and therefore no further surveys are proposed. This assessment will be informed by the worst case parameters for the physical presence of infrastructure on the seabed.
EMF effects arising from cables during operational phase	Operation and Maintenance	C-1; C-8; C-12; C-29	Possible likely significant effect without secondary mitigation - **Scoped In**	EMF may impact sensitive species, including elasmobranchs, teleost fish (i.e., flat fish, salmonids and gadoids) and crustaceans (e.g. brown crab (Scott *et al.,* 2018; Scott *et al.,* 2021, Tricas & Gill, 2011)) by altering foraging or migratory behaviour (Hutchison *et al.,* 2020). The magnitude of this impact will depend in part on the project design and the burial and cable protection measures which are utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column. This assessment will be informed by the worst-case parameters for the presence of cables on the sea floor and the burial and cable protection measures utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column. It is acknowledged that there is limited, but emerging research on EMF impacts on fish and shellfish, especially for dynamic cables. The impact assessment will draw on the latest relevant available literature. No cable specific modelling is proposed.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Introduction of new hard substrates and potential for fish aggregation	Operation and Maintenance	C-6	Possible likely significant effect without secondary mitigation - **Scoped In**	Installed infrastructure may introduce new hard substrate for colonisation by encrusting marine organisms, including marine fauna that are not currently found in the existing environment. The EMP will include measures to reduce the spread of invasive species. Offshore infrastructure may act as a Fish Aggregation Device (FAD), providing refuge for some species and also habitat for some shellfish and benthic species, whilst also potentially attracting larger predators which could indirectly increase entanglement or collision risk for both fish and marine mammal species. This assessment will be informed by the worst case parameters for the installed infrastructure during the operation and maintenance phase.
Increased risk of introduction or spread of Invasive Non-Native Species (INNS)	Operation and Maintenance	C-6; C-8; C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	Increased risk of introduction or spread of Marine INNS due to the presence of the subsea infrastructures and increased vessel movements may facilitate the spread of non-native species and may subsequently impact biodiversity and assemblages of Fish and Shellfish ecology of the area. The potential introduction or spread of Marine INNS and subsequent impact to local Fish and Shellfish ecology receptors will be assessed based on current industry understanding, available literature and expert knowledge. The assessment will take into consideration the mitigation and control of invasive species measures that will be incorporated into a EMP. Consideration of the mitigation and control of invasive species measures in line with IMO will be given (IMO, 2019). These standards and procedures will be incorporated into the EMP and are embedded in the project design and as such ensure that no significant effects arise from INNS. This assessment will be informed by the worst case parameters for the installed infrastructure during the operation and maintenance phase.
Ghost fishing due to lost fishing gear becoming entangled in installed infrastructure	Operation and Maintenance	C-1; C-8; C-12; C-29	Possible likely significant effect without secondary mitigation - **Scoped In**	There is the potential for lost gear to become entangled within mooring lines and suspended cables associated with floating substructures, if this technology is utilised, leading to ghost fishing which may negatively impact fish and shellfish. This assessment will be informed by the worst-case parameters relating to the presence of mooring lines and suspended cables. Where appropriate, the impact assessment will draw on the latest relevant available literature on this impact.
Direct damage (e.g, crushing) and disturbance to mobile demersal	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	There is potential for direct damage to occur during construction activities in the Array Areas and along the Offshore ECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. There is also the potential for direct damage to occur as a result of decommissioning activities. Affected species are however likely to be mobile and can move away from

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
and pelagic fish and shellfish species				disturbance, furthermore, crushing impacts on stationary receptors will be small scale, and will not result in population level effects.
Accidental pollution even during construction or decommissioning activity	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	Accidental releases of pollutants may arise as a result of accidental spills from vessels or other equipment and have detrimental effects on fish and shellfish. However, the risk and impact of accidental releases of hazardous substances will be reduced through the implementation of the EMP, including measures for compliance with international requirements of the International Convention for the Prevention of Pollution from Ships MARPOL) convention, as well as best practice for works in the marine environment (e.g., preparation of Shipboard Oil Pollution Emergency Plans (SOPEP)). In this manner, accidental release of potential contaminants from construction vessels will be strictly controlled and procedures will be in place to minimum the impact of any accidental release if it occurs, and hence the impact has been scoped out of the EIA.
Direct disturbance resulting from maintenance during operational phase	Operation and Maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	There is the potential for direct habitat disturbance of the seabed during planned and unplanned maintenance activities (e.g., the use of jack up vessels or cable repair or replacement). However, affected fish and shellfish species are likely to be mobile and can move away from disturbance.
Accidental pollution during operational phase	Operation and Maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	See justification described for accidental pollution events during construction and decommissioning activity above.
Underwater noise	Operation and Maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	Underwater noise as a result of operational turbines, has a relatively low frequency and pressure level (Andersson *et al.,* 2011). A desk-based literature review of existing data and past studies of underwater noise associated with operational OWFs concludes the expectation that there will be no likely significant effects on Fish and Shellfish communities. It is important to note, operational noise generated from maintenance vessel traffic is likely to be low would only have an impact on fish species if they remained in close proximity to the vessel for hours.

5 Marine Mammals

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Underwater noise impacts from piling	Construction and Decommissioning	C-11	Possible likely significant effect without secondary mitigation - **Scoped In**	Underwater noise generated from piling has the potential to result in auditory injury in the form of a permanent threshold shift (PTS) in hearing. Additionally piling has the potential to have an impact on individuals and populations via a temporary threshold shift (TTS) in hearing, behavioural disturbance and/or displacement. Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with the Project Design Envelope. Worst case underwater noise modelling locations in the Array Areas will be selected based on perceived impacts to marine mammal receptors and will consider variables such as proximity to designated sites or depth contours. The outputs of underwater noise modelling will be used to understand the impacts on marine mammals and determine significance of effects, with reference to noise exposure guidelines.
Underwater noise from UXO clearance	Construction and Decommissioning	C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	Underwater noise generated from UXO clearance has the potential to result in auditory injury in the form of PTS. Additionally, UXO clearance has the potential to have an impact on individuals and populations via a temporary threshold shift (TTS) in hearing, behavioural disturbance and/or displacement. Whilst low order clearance (e.g. deflagration) techniques are understood to exist, for underwater noise modelling high order clearance would be modelled as a worst-case scenario. Underwater noise modelling and impact ranges from UXO clearance is available from monitoring at other developments. A range of charge weights will be presented and assessed for impacts to marine mammals, with the maximum charge weight being informed by other developments in the area. The impact ranges will be used to understand the impacts on marine mammals and determine significance of effects, with reference to noise exposure guidelines.
Underwater noise impacts from other construction activities	Construction and Decommissioning	C-6	Possible likely significant effect without secondary mitigation - **Scoped In**	Underwater noise generated from geophysical surveys and other construction activities such as cable laying, dredging, and trenching have the potential to result in auditory injury (PTS), TTS in hearing, behavioural disturbance and/or displacement. Impact ranges from geophysical surveys and other construction activities are available from monitoring at other developments and in impact ranges will be used to understand the impacts on marine mammals and determine significance of effects, with reference to noise exposure guidelines.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Indirect impacts on marine mammal prey species from underwater noise	Construction and Decommissioning	Listed in Chapter 9: Fish and Shellfish Ecology	Possible likely significant effect without secondary mitigation - **Scoped In**	Impacts from construction, operation and maintenance, and decommissioning activities on fish and shellfish receptors could lead to changes in prey availability, distribution and abundance and, as a result, potentially impact on marine mammal foraging success. In particular, underwater noise impacts from piling, UXO clearance, geophysical surveys and other construction activities may lead to mortality, injury or disturbance to prey populations. Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with the Project Design Envelope. The impacts to prey species will be assessed using the noise modelling outputs and the noise exposure guidelines. Indirect effects of fish as prey will be inferred from these outputs.
Collision risk associated with increased vessel traffic in the Array Areas and Offshore ECC	Construction and Decommissioning	C-13	Possible likely significant effect without secondary mitigation - **Scoped In**	Increased vessel presence in the area associated with the development could lead to a potential increase in collision risk with marine mammals. Whilst collision risk is unlikely, the potential severity of injury can range from minor (recoverable) to major (mortality). Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Project Design Envelope.
Disturbance impacts associated with increased vessel traffic in the Array Areas and Offshore ECC	Construction and Decommissioning	C-13	Possible likely significant effect without secondary mitigation - **Scoped In**	There will be an existing baseline for vessel traffic in the area comprised of passenger, cargo and other vessel types. Increased vessel presence in the area associated with the development could lead to a potential increase in disturbance and/or displacement to marine mammals. Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Project Design Envelope.
Disturbance at haul-out sites	Construction and Decommissioning	C-13	Possible likely significant effect without secondary mitigation - **Scoped In**	There are seal haul-outs close to the Offshore ECC and Landfall there is therefore the potential for disturbance. Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Project Design Envelope.
Indirect impacts on marine mammal prey species from underwater noise	Operation and Maintenance	Listed in Chapter 9: Fish and Shellfish Ecology	Possible likely significant effect without secondary mitigation - **Scoped In**	Impacts from construction, operation and maintenance, and decommissioning activities on fish and shellfish receptors could lead to changes in prey availability (e.g. distribution and abundance) and, as a result, potentially impact on marine mammal foraging success. In particular, underwater noise impacts from piling, UXO clearance, geophysical surveys and other construction activities may lead to mortality, injury or disturbance to prey species.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
				Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with the Project Design Envelope. The impacts to prey species will be assessed using the noise modelling outputs and the noise exposure guidelines. Indirect effects of fish as prey will be inferred from these outputs.
Collision risk associated with increased vessel traffic in the Array Areas and Offshore ECC	Operation and Maintenance	C-13	Possible likely significant effect without secondary mitigation - **Scoped In**	Increased vessel presence in the area associated with the development could lead to a potential increase in collision risk with marine mammals. Whilst collision risk is unlikely, the potential severity of injury can range from minor (recoverable) to major (mortality). Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Project Design Envelope.
Disturbance impacts associated with increased vessel traffic in the Array Areas and Offshore ECC	Operation and Maintenance	C-13	Possible likely significant effect without secondary mitigation - **Scoped In**	There will be an existing baseline for vessel traffic in the area comprised of passenger, cargo and other vessel types. Increased vessel presence in the area associated with the development could lead to a potential increase in disturbance and/or displacement to marine mammals. Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Project Design Envelope.
Disturbance at haul-out sites	Operation and Maintenance	C-13	Possible likely significant effect without secondary mitigation - **Scoped In**	There are seal haul-outs close to the Offshore ECC and Landfall there is therefore the potential for disturbance. Impact assessment will be based on the worst-case scenario number of vessels and transits as detailed in the Project Design Envelope.
Noise related impacts associated with Floating foundations	Operation and Maintenance	-	Possible likely significant effect without secondary mitigation - **Scoped In**	Underwater noise from operational fixed bottom offshore wind farms is likely to be less of an impact compared to underwater noise produced during the floating offshore wind farm construction phase. It is anticipated that impacts would be negligible to marine mammals; however, there is uncertainty associated with floating offshore wind, new technologies and limited monitoring data, so this impact has been scoped in. This is in line with Scottish Ministers, Marine Scotland Science and NatureScot representations advice in recent Scoping Opinions (Marine Scotland, 2022; Marine Scotland 2023; Marine Directorate 2023a; Marine Directorate 2023b). Underwater noise modelling will be undertaken based on the parameters in the worst-case scenario associated with the Project Design Envelope. The outputs of underwater noise modelling will be used to assess the impacts on marine mammals and determine significance of effects, with reference to noise exposure guidelines

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Injury risk from entanglement of marine mammals with Wind Turbine Generator (WTG) mooring line and cables (primary interaction), and/or with discarded fishing gear wrapped around mooring lines (secondary interaction).	Operation and Maintenance	C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The effects of floating offshore wind and entanglement in mooring lines is poorly understood. However, focus on entanglement risk with floating wind is often on derelict or lost fishing gear, which has the potential to entangle with moorings and could lead to marine mammal entanglement. This is in line with consultation feedback for other projects, where the potential for entanglement with debris caught in mooring lines (indirect entanglement) must be included at EIA (Marine Scotland, 2021; Marine Scotland, 2023). Impact assessment will be based on the worst-case scenario as detailed in the Project Design Envelope.
Collision risk with Floating foundations	Operation and Maintenance	C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The floating substructure is still to be defined. The collision risk between marine mammals and these structures is thought to be negligible based on marine mammal behaviour but is poorly understood. Given this knowledge gap, this has been scoped in on a precautionary basis. Impact assessment will be based on the worst-case scenario as detailed in the Project Design Envelope.
Impacts on marine mammal prey species from electromagnetic fields (EMF) due to subsea cable installation	Operation and Maintenance	Listed in Chapter 9: Fish and Shellfish Ecology	Possible likely significant effect without secondary mitigation - **Scoped In**	The potential EMF impacts on prey species may impact foraging for marine mammals. EMF impacts on fish and shellfish (prey) species will be assessed in the Fish and Shellfish Ecology chapter at the EIA Report stage. Impact assessment will be based on the worst-case scenario as detailed in the Project Design Envelope and on the impact assessment presented in the Fish and Shellfish Ecology chapter in the EIA.
Habitat change, displacement or barrier effects due to presence of WTG and mooring lines	Operation and Maintenance	C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The impacts of floating wind on marine mammals are poorly understood, with the introduction of new infrastructure, mooring lines and cables to the marine environment potentially resulting in the displacement or exclusion of marine mammals from an area. It is also possible there may be changes to habitat which influence the abundance and distribution of prey species. Impact assessment will be based on the worst-case scenario as detailed in the Project Design Envelope.
Changes in water quality from activities in the Array Areas and Offshore ECC	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	Activities relating to construction, operation and maintenance or decommissioning may influence water quality as a result of sediment disturbance, this is anticipated to be short-term and localised. Marine mammals are known to forage in tidal areas where water conditions are turbid and visibility is poor (e.g., Pierpoint 2008, Marubini *et al.* 2009, Hastie *et al.* 2016); therefore, low light levels, turbid

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
				waters and suspended sediments are unlikely to negatively impact marine mammal foraging success. Hearing, not vision, is the primary sensory modality for most marine mammal species. When the visual sensory systems of marine mammals are compromised, they can 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 low light levels.
Changes in water quality from activities in the Array Areas and Offshore ECC	Operation and Maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	Activities relating to construction, operation and maintenance or decommissioning may influence water quality as a result of sediment disturbance, this is anticipated to be short-term and localised. Marine mammals are known to forage in tidal areas where water conditions are turbid and visibility is poor (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. Hearing, not vision, is the primary sensory modality for most marine mammal species. When the visual sensory systems of marine mammals are compromised, they can 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 low light levels.
Changes to water quality relating to accidental pollutant release	Operation and Maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	Accidental release of pollutants from spills or contaminant releases may lead to mortality of marine mammals or reduction in prey availability. However, the implementation of an EMP (C-6) and MPCP (C-9) will mean that any impacts occurring from such events would not have impacts at the population level. It is also anticipated that if such an event did occur, it would be short-term and localised.
Impacts on marine mammals from EMF due to subsea cable installation	Operation and Maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	Subsea cables emit EMF, however existing evidence suggests that the levels of EMF emitted by offshore renewable energy export cables are at a low level, relative to this receptor group, such that there is no potential for direct significant impacts on marine mammals (Copping and Hemery 2020). To date, the only marine mammal species known to show any response to EMF is a non-UK species, the Guiana dolphin (*Sotalia guianensis*). This species has 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. EMF effects on potential prey species will be considered in the benthic ecology and fish and shellfish chapters of the EIA Report.

6 Offshore Ornithology

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Direct temporary habitat loss/disturbance and disturbance and displacement from wet storage for floating foundations and/or Wind Turbine Generators (WTGs)	Construction and Decommissioning	C-12; C-13; C-14; C-15; C-16	Possible likely significant effect without secondary mitigation - **Scoped In**	Construction of the OWF will result in increased vessel activity, airborne noise and underwater noise. This disturbance may displace IOFs from important feeding and roosting areas, especially if habitat is directly lost during construction. These impacts may occur across both the Offshore ECC and Array Areas and a buffer around them, as well as when vessels are transiting. The presence of floating foundations and/or WTGs in wet storage areas (which are currently not defined) may lead to disturbance and displacement of species within this area. These impacts will be temporally limited due to the limited duration of wet storage during the construction phase. Displacement Analysis; Population Viability Analysis (Chapter 11: Offshore Ornithology) A quantified assessment based on the area of seabed disturbed and the impact from vessels on birds during construction.
Indirect impacts due to impacts on prey species during construction	Construction and Decommissioning	C-12; C-15	Possible likely significant effect without secondary mitigation - **Scoped In**	Construction impacts, including underwater noise from piling and the generation of suspended sediments, may alter the distribution, physiology, or behaviour of bird prey species. This may reduce the amount of prey available around the construction works, indirectly impacting IOFs. Qualitative Analysis; Noise modelling for the Project will be used to determine potential impacts on prey species from construction noise. Results from the Fish and Shellfish chapter will be used to establish the potential effects on birds. A qualitative assessment will be undertaken using the predicted extent of the impact and relevant literature in regards to fish behaviour towards noise.
Impacts resulting from artificial light	Construction and Decommissioning	C-8; C-12; C-16	Possible likely significant effect without secondary mitigation - **Scoped In**	Impacts resulting from artificial light are expected to be minimal; however, there is some evidence that European storm petrel can be impacted by artificial light. They were recorded in the site-specific DAS for the Offshore Proposed Development. Qualitative Analysis; A qualitative assessment undertaken based on the latest published literature on the impacts artificial lighting has on seabirds..
Indirect effects due to UXO clearance	Construction and Decommissioning	C-8	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	UXO clearance has the potential to cause physical injury and death to diving offshore ornithology receptors below water at time of UXO detonation. The reduction or disruption of prey availability due to detonations may cause reduced energy intake affecting productivity or survival of offshore ornithology receptors.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
				Qualitative Analysis; Noise modelling for the Project will be used to determine potential impacts on prey species from UXO clearance and a qualitative assessment undertaken based on predicted area of impact and the known behaviour of fish from noise using the latest published literature.
Disturbance and displacement (from physical presence of WTG and maintenance vessels)	Operation and Maintenance	C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	Activities associated with the maintenance of the Offshore ECC will result in the presence of vessels within the Offshore ECC. This may disturb and displace bird species within the Offshore ECC and Array Area. However, this impact is likely to be both spatially and temporally restricted, with maintenance within the Offshore ECC during the O&M phase being sporadic, temporary and only undertaken on restricted areas of the Offshore ECC and Array Area. Displacement Analysis; Population Viability Analysis (Chapter 11: Offshore Ornithology). Both displacement modelling and PVA will be undertaken to quantify the level of impact from displacement.
Distributional Responses	Operation and Maintenance	C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	It is not usually possible to distinguish between displacement and barrier effects for resident birds. It is it not usually possible to define where individual birds intend to travel to in and beyond and OWF, even when tracking data are available. Both sitting and flying birds will be included within the displacement analysis. The inclusion of sitting birds within the analysis accounts for those individuals who are potentially displaced from an area of sea in which they reside. The inclusion of flying birds accounts for any potential barrier effects. Therefore, the impact assessment will consider the effects of displacement and barrier effects on IOFs together. The impacts on barrier effects alone will not be considered as a separate impact. Displacement Analysis; Population Viability Analysis (Chapter 11: Offshore Ornithology). Barrier effects will be assessed alongside disturbance and displacement, using the recommended SNCB matrix approach and PVA.
Collision Risk	Operation and Maintenance	C-12; C-43	Possible likely significant effect without secondary mitigation - **Scoped In**	There is a risk of birds in flight colliding with rotating WTG blades. The risk that collision poses to individual IOFs is species-dependent based on their morphological and behavioural characteristics. Collision Risk Assessment; Migratory Birds Report; Population Viability Analysis (Chapter 11: Offshore Ornithology). Collision risk modelling and PVA will be undertaken to quantify the estimated level of impact.
Entanglement	Operation and Maintenance	C-12	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Whilst little is currently known about it, the potential exists for entanglement of diving seabirds with floating foundations during the operation and maintenance period.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
				Qualitative Analysis; A qualitative assessment undertaken based on the latest published literature on the impacts of entanglement has on seabirds.
Indirect impacts due to impacts on prey species	Operation and Maintenance	C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of turbines may alter the distribution, physiology, or behaviour of bird prey species. These effects could potentially result in less prey being available in the Array Areas and surrounding buffer, impacting foraging seabirds. Qualitative Analysis; Noise modelling for the Project will be used to determine potential impacts on prey species from construction noise. Results from the Fish and Shellfish chapter will be used to establish the potential effects on birds. A qualitative assessment will be undertaken using the predicted extent of the impact and relevant literature in regards to fish behaviour towards noise.
Impacts from artificial light	Operation and Maintenance	C-12; C-16	Possible likely significant effect without secondary mitigation - **Scoped In**	Impacts resulting from artificial light are expected to be minimal; however, there is some evidence European storm petrel can be impacted by artificial light. They were recorded in the site-specific DAS for the Offshore Proposed Development. Qualitative Analysis; A qualitative assessment undertaken based on the latest published literature on the impacts artificial lighting has on seabirds.
Impacts resulting from accidental pollution during construction	Construction and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	Accidental pollution during the construction of OWF infrastructure and use of service vessels may result in spills or contaminant release. These potential impacts can result in the direct mortality of IOFs or the reduction of prey availability. During consent applications for other OWFs, it has been agreed with stakeholders that with the implementation of an appropriate Construction Programme (CoP), direct mortality within the wind farm Array Areas plus buffer is very unlikely to occur. A major incident that may impact any species at a population level is therefore considered extremely unlikely. The potential pollution events of other OWFs are predicted to be of local spatial extent, short term duration, and insignificant in EIA terms. This is considered equally applicable for this Offshore Proposed Development. The Offshore Proposed Development will be comparable in scale and operation, whilst also implementing an appropriate CoP. Proposed construction methods and roles and responsibilities of parties involved will be detailed in a Construction Method Statement (CMS). Therefore, subject to consultation with the stakeholders and feedback on this scoping report, this impact pathway will be scoped out from further consideration within the EIA.
Barrier effect for migration species	Construction and Decommissioning	NA	No likely significant affect at Scoping - **Scoped Out**	The small energetic cost of migrating birds flying around rather than through the Array Areas is considered a potential barrier effect. Masden *et al*. (2010; 2012) and Speakman *et al.* (2009) calculated

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
				that the costs of one-off avoidances during migration were small, accounting for less than 2% of available fat reserves. The inclusion of flying birds in the displacement assessment accounts for any potential barrier effects. Therefore, a separate assessment for the effects of barrier effects on IOFs is not necessary and has scoped out.

7 Seascape, Landscape and Visual Impact Assessment

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Impact (daytime) of the construction of the Offshore Proposed Development on coastal character	Construction and Decommissioning	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for short-term, temporary impacts on perceived seascape coastal character, arising as a result of the construction activities and structures that comprise the Offshore Proposed Development located within the Project, which may alter the seascape character of the area within the Array areas itself themselves and the perceived character of the wider seascape through visibility of these changes. Included in the landscape impact assessment.
Impact (daytime) of the construction of the Offshore Proposed Development on perceived landscape character	Construction and Decommissioning	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for short-term, temporary impacts on perceived landscape character, arising because of the construction activities and structures that comprise the Offshore Proposed Development located within the Project, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character of the landscape. Included in the landscape impact assessment.
Impact (daytime) of the construction of the Offshore Proposed Development on perceived landscape character/special qualities of designated landscapes	Construction and Decommissioning	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for short-term, temporary impacts on perceived landscape character and special qualities of designated landscapes, arising because of the construction activities and structures that comprise the Offshore Proposed Development within the Project, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character and qualities of the landscape. Included in the landscape impact assessment.
Impact (daytime) of the construction of the Offshore Proposed Development on visual receptors/ views	Construction and Decommissioning	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for short-term, temporary impacts on views and visual amenity experienced by people from principal visual receptors and representative viewpoints, arising because of the construction activities and structures, which may be visible from the coast (during good to excellent visibility conditions) and may therefore affect views and visual amenity. Included in the visual impact assessment.
Impact (daytime) of the operation and maintenance of the Offshore Proposed Development on coastal character	Operation and maintenance	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for significant effect. Long term, reversible effects on perceived seascape character, arising as a result of the operational wind turbines, substations and maintenance activities located within the Array Areas, which may alter the perceived character. Included in the landscape impact assessment.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Effects (daytime) of the operation and maintenance of the Offshore Proposed Development on perceived landscape character/special qualities of designated landscapes	Operation and maintenance	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for significant effect. Long term, reversible effects on perceived landscape character of LCTs and qualities of designated landscapes, arising because of the operational wind turbines, substations, and maintenance activities, which will be visible from the coast (during good to excellent visibility conditions) and may therefore affect the perceived character and qualities of the landscape. Included in the landscape impact assessment.
Effects (daytime) of the operation and maintenance of the Offshore Proposed Development on visual receptors/views	Operation and maintenance	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for significant effect. Long term, reversible effects on views and visual amenity experienced by people as principal visual receptors and representative viewpoints, arising because of the operational WTGs, potential offshore substations, and maintenance activities when visible from the coast during very good to excellent visibility conditions. Included in the visual impact assessment.
Effects (daytime) of the operation and maintenance of the Offshore Proposed Development on views experienced by offshore visual receptors	Operation and maintenance	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for significant effect. Long term, reversible effects on views and visual amenity experienced by offshore visual receptors, arising because of the operational WTGs, potential offshore substations, and maintenance activities when visible during very good to excellent visibility conditions. Included in the visual impact assessment.
Effects (night-time) of the operation and maintenance of the Offshore Proposed Development visible aviation lighting on visual receptors/ views	Operation and maintenance	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for significant effect. Long term, reversible effects on views and visual amenity experienced by people from principal visual receptors and representative viewpoints arising because of the marine navigation and visible aviation lights. Included in the visual impact assessment.
Cumulative effect (daytime) of the operation of the Offshore Proposed Development on seascape coastal character, landscape character and views/ visual receptors	Operation and maintenance	C-2, C-5, C-14	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	Potential for significant cumulative effect. Long term, reversible effects on perceived seascape character, landscape character of LCTs and qualities of designated landscapes, and views/visual amenity experienced by people arising as a result of visibility of the operational wind turbines, substations and maintenance activities located within the Offshore Proposed Development cumulatively with other proposed offshore windfarms located within the 60 km study area. Included in cumulative landscape and visual impact assessment. Included in cumulative landscape and visual impact assessment.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Construction phase seascape, landscape, and visual impacts of the Offshore Proposed Development outside the 60 km radius SLVIA study area.	Construction (and Decommissioning)	N/A	No likely significant affect at Scoping - **Scoped Out**	The 60 km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 60 km due to the limited changes to views arising from the Offshore Proposed Development over such distances.
Impacts of the construction of the Offshore Proposed Development on physical aspects of landscape character.	Construction (and Decommissioning)	N/A	No likely significant affect at Scoping - **Scoped Out**	Due to the location of the Offshore Proposed Development largely at a considerable distance offshore it will only impact on the perception of character and qualities – which is considered as an indirect effect in LVIA. No physical attributes that define landscape character or special qualities of designated landscapes will be changed because of the Offshore Proposed Development.
The seascape and landscape impacts of the Offshore Export Cable construction.	Construction (and Decommissioning)	N/A	No likely significant affect at Scoping - **Scoped Out**	Limited influence on seascape and landscape, and receptors due to sporadic, temporary nature of above sea construction processes. The activities mainly occur from vessels, which are already an apparent component of the baseline seascape and landscape character. .
The visual impact of the Offshore Export Cable construction beyond 1km from Landfall	Construction (and Decommissioning)	N/A	No likely significant affect at Scoping - **Scoped Out**	Limited influence on visual receptors beyond this distance due to sporadic, temporary nature of above sea construction processes. The activities mainly occur from vessels, which are already an apparent component of baseline views.
Impact of the Array Areas lighting on seascape coastal, landscape character and visual receptors at night during construction and operation and maintenance	Construction Operation and Maintenance (and Decommissioning)	N/A	No likely significant affect at Scoping - **Scoped Out**	Navigational lights associated with construction buoyage and construction vessels will not be visible from the coast. Aviation marking lights may be required on top of cranes associated with heavy lift vessels or jack up vessels, however, these will be temporary in nature. The matter of visible aviation lighting assessment will be assessed as wholly a visual matter as it is considered that the proposed aviation lighting will not have significant effects on the perception of landscape or seascape character, which is not readily perceived at night in darkness. No attributes of seascape or landscape character will be changed because of the lighting of the Project.
Impact of the Offshore Proposed Development on the Shetland NSA Special Qualities listed in Chapter 12: SLVIA section 12.4.3.1	Construction Operation and Maintenance (and Decommissioning)	N/A	No likely significant affect at Scoping - **Scoped Out**	These Special Qualities would not be materially affected by the construction and operation of the Offshore Proposed Development.
Impacts on the Ronas Hill and North Roe Wild Land Area	Construction Operation and	N/A	No likely significant affect at Scoping - **Scoped Out**	The perceived wildness within this area would not be materially affected by the construction or operation of the Offshore Proposed Development due to the 57.4 km distance to the Array Areas.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
	Maintenance (and Decommissioning)			
Impacts on Belmount House and Gardie House GDLs	Construction Operation and Maintenance (and Decommissioning)	N/A	No likely significant affect at Scoping - **Scoped Out**	These GDLs would not be materially affected by the construction or operation of the Offshore Proposed Development as the GDLs are not within the ZTV of the Array Areas.
Operation and maintenance phase seascape, landscape, and visual impacts of the offshore elements of the Offshore Proposed Development outside the 60 km radius SLVIA study area (Chapter 12: SLVIA; Figure 12.1).	Operation and maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	The 60 km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 60 km due to the limited changes to views arising from the Offshore Proposed Development over such considerable distance.
Impact of the aviation lighting on seascape coastal character and landscape character at night during operation and maintenance	Operation and maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	The matter of visible aviation lighting assessment will be assessed as wholly a visual matter as it is considered that the proposed aviation lighting will not have significant effects on the perception of landscape or seascape character, which is not readily perceived at night in darkness. No attributes of seascape or landscape character will be changed because of the lighting of the Project.
Impact of the Offshore Proposed Development on the Shetland NSA Special Qualities listed in section 12.4.3.1	Operation and maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	These Special Qualities would not be materially affected by the operation of the Offshore Proposed Development.
Impacts on the Ronas Hill and North Roe Wild Land Area	Operation and maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	The perceived wildness within this area would not be materially affected by the operation of the Offshore Proposed Development due to the 57.4km distance to the Array Areas.
Impacts on Belmount House and Gardie House GDLs	Operation and maintenance	N/A	No likely significant affect at Scoping - **Scoped Out**	These GDLs would not be materially affected by the operation of the Offshore Proposed Development as the GDLs are not within the ZTV of the Array Areas.

8 Commercial Fisheries

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Temporary reduction in access to, or exclusion from established fishing grounds	Construction (and Decommissioning)	C-1, C-3, C-7, C-10, C-12, C-14, C-15, C-16, C-21, C-22, C-23, C-24, C-28, C-29, C-32, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	Installation and decommissioning activities have potential to create loss of fishing opportunities. This effect is expected to be localised and short term; furthermore, the operational range of relevant fleets will not typically be limited to the Offshore Proposed Development. Desktop study, analysis of statistics and geographic information systems (GIS) supported by consultation with stakeholders.
Temporary displacement of fishing activity leading to gear conflict and increased fishing pressure on adjacent grounds	Construction (and Decommissioning)	C-1, C-3, C-7, C-12, C-14, C-15, C-21, C-22, C-23, C-24, C-29, C-32, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This effect is expected to be short-term and the operational range of relevant fleets will not typically be limited to the Offshore Proposed Development. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	Construction (and Decommissioning)	C-3, C-7, C-12, C-14, C-15, C-21, C-22, C-23, C-29, C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Installation and decommissioning activities may lead to disturbance of commercially important fish and shellfish resources, which in turn may result in displace or disrupt a range of fishing activity. Assessment will be informed by the outcomes of the fish and shellfish ecology impact assessment, and it will be assumed that commercial fisheries will be affected as a result of any loss of resources. Desktop study supported by Fish and Shellfish Ecology Chapter and consultation with stakeholders.
Increased vessel traffic associated with the Proposed Development within fishing grounds leading to interference with fishing activity	Construction (and Decommissioning)	C-3, C-7, C-10, C-14, C-15, C-16, C-21, C-22, C-23, C-24, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	Movement of vessels associated with the Offshore Proposed Development adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Assessment will be informed by the outcomes of the shipping and navigation impact assessment and Navigational Risk Assessment (NRA). Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.
Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	Construction (and Decommissioning)	C-1, C-3, C-7, C-14, C-16, C-21, C-22, C-23, C-24, C-28, C-29, C-32, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of partially constructed infrastructure (e.g. cable/scour protection, subsea cable hubs) and other seabed obstacles, may pose a snagging risk to fishing vessels, which could result in loss or damage to fishing gear. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Offshore Proposed Development	Construction (and Decommissioning)	C-3, C-7, C-10, C-14, C-15, C-16, C-21, C-22, C-23, C-24	Possible likely significant effect without secondary mitigation - **Scoped In**	Installation and decommissioning activities have potential to create loss of fishing opportunities. Seeking alternative fishing grounds may lead to additional steaming time. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.
Reduction in access to, or exclusion from established fishing grounds	Operation and Maintenance	C-1, C-3, C-7, C-10, C-12, C-16, C-17, C-21, C-22, C-23, C-24, C-28, C-29, C-32, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of offshore infrastructure within the Offshore Proposed Development may result in a loss or restricted access to fishing grounds during the operation and maintenance phase. As floating offshore wind is a relatively new technology, there is limited information available on the scale of this impact. Access to fishing grounds within the Offshore Proposed Development will be dependent on turbine spacing, turbine layout, floating substructure type and station keeping system design. In particular, the mooring associated with the station keeping system and the any dynamic inter-array cable design may affect the ability of commercial fishing fleets in deploying fishing gear. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	Operation and Maintenance	C-1, C-3, C-7, C-12, C-17, C-21, C-22, C-23, C-24, C-29, C-32, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This effect is expected to be medium-long term and the operational range of relevant fleets will not typically be limited to the Offshore Proposed Development. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	Operation and Maintenance	C-3, C-7, C-12, C-17, C-21, C-22, C-23, C-29, C-32	Possible likely significant effect without secondary mitigation - **Scoped In**	Operation and maintenance of the Offshore Proposed Development may lead to disturbance of commercially important fish and shellfish resources, including electromagnetic fields from inter-array cables, and changes to habitat, and therefore displace or disrupt a range of fishing activity. Assessment will be informed by the outcomes of the fish and shellfish ecology impact assessment, and it will be assumed that commercial fisheries will be affected as a result of any loss of resources. Desktop study supported by Fish and Shellfish Ecology Chapter and consultation with stakeholders.
Increased vessel traffic associated with the Offshore Proposed Development within fishing grounds leading to interference with fishing activity	Operation and Maintenance	C-3, C-7, C-10, C-16, C-17, C-21, C-22, C-23, C-24, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	Movement of vessels associated with operation and maintenance of the Offshore Proposed Development adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Assessment will be informed by the outcomes of the shipping and navigation impact assessment and NRA. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	Operation and Maintenance	C-1, C-3, C-7, C-16, C-17, C-21, C-22, C-23, C-24, C-28, C-29, C-32, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of infrastructure associated with operation and maintenance (e.g. cable/scour protection, subsea cable hubs) and other seabed obstacles, may pose a snagging risk to fishing vessels, which could result in loss or damage to fishing gear. The extent of impact may vary depending upon the project design. Standard industry practice and protocol (e.g., seabed infrastructure will be buried and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern. Safety aspects associated with this impact, including damage to property and vessel stability, will be considered within the shipping and navigation impact assessment. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.
Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Offshore Proposed Development	Operation and Maintenance	C-3, C-7, C-10, C-16, C-17, C-21, C-22, C-23, C-24	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of offshore infrastructure within the Offshore Proposed Development may result in a loss or restricted access to fishing grounds during the operation and maintenance phase. Seeking alternative fishing grounds may lead to additional steaming time. Desktop study, analysis of statistics and GIS supported by consultation with stakeholders.

9 Aviation and Radar

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Creation of an aviation obstacle environment	Construction	C-16, C-18, C-33, C-34, C-38, C-39, C-40.	Possible likely significant effect without secondary mitigation - **Scoped In**	Construction and decommissioning of the wind farm may involve tall crane vessels creating a physical obstruction. The presence of WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs and associated obstructions will have a potential impact on military low flying aircraft, Sumburgh Airport IFPs, helicopter traffic in support of offshore oil and gas, and SAR operations. An IFP assessment will be necessary to determine if the Offshore Proposed Development will impact Sumburgh Airport IFPs.
Increased air traffic in the area related to wind farm activities	Construction	C-16, C-18, C-33, C-34, C-38, C-39, C-40.	Possible likely significant effect without secondary mitigation - **Scoped In**	Helicopter traffic involved in all stages of the Project could affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing traffic will include low flying aircraft and helicopters in support of the oil and gas industry.
Effect on civil and military PSR systems	Construction	N/A	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	To discriminate between aircraft targets and clutter, PSRs ignore static objects and only display moving targets. PSRs that can see rotating blades of WTGs can mistake them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from clutter. This is only applicable when WTGs begin rotation. Tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter. WTGs will be gradually commissioned during the construction phase. Effects on civil and military PSR systems is scoped out of the construction period prior to first energy. Specifically, WTGs within the Offshore Proposed Development Array Areas have the potential to impact the Saxa Vord AD radar and the NATS operated radar at Sumburgh Airport. Consultation with the MOD, NATS and HIAL is necessary to ascertain mitigation options if applicable.
Transboundary impact	Construction	C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The Array Areas infringe Polaris FIR airspace regulated by CAA Norway. Consultation with CAA Norway will determine the extent of the transboundary impact the Project will have at all stages.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Creation of an aviation obstacle environment	Operation and Maintenance	C-16, C-18, C-33, C-34, C-38, C-39, C-40	Possible likely significant effect without secondary mitigation - **Scoped In**	Construction and decommissioning of the wind farm may involve tall crane vessels creating a physical obstruction. The presence of WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs and associated obstructions will have a potential impact on military low flying aircraft, Sumburgh Airport IFPs, helicopter traffic in support of offshore oil and gas, and SAR operations. An IFP assessment will be necessary to determine if the Offshore Proposed Development will impact Sumburgh Airport IFPs.
Increased air traffic in the area related to wind farm activities	Operation and Maintenance	C-16, C-18, C-33, C-34, C-38, C-39, C-40	Possible likely significant effect without secondary mitigation - **Scoped In**	Helicopter traffic involved in all stages of the Project could affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing traffic will include low flying aircraft and helicopters in support of the oil and gas industry.
Effect on civil and military PSR systems	Operation and Maintenance	N/A	Likely significant effect without secondary mitigation - Detailed assessment - **Scoped In**	To discriminate between aircraft targets and clutter, PSRs ignore static objects and only display moving targets. PSRs that can see rotating blades of WTGs can mistake them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from clutter. This is only applicable when WTGs begin rotation. Tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter. WTGs will be gradually commissioned during the construction phase. Effects on civil and military PSR systems is scoped out of the construction period prior to first energy. Specifically, WTGs within the Offshore Proposed Development Array Areas have the potential to impact the Saxa Vord AD radar and the NATS operated radar at Sumburgh Airport. Consultation with the MOD, NATS and HIAL is necessary to ascertain mitigation options if applicable.
Transboundary impact	Operation and Maintenance	C-34	Possible likely significant effect without secondary mitigation -**Scoped In**	The Array Areas infringe Polaris FIR airspace regulated by CAA Norway. Consultation with CAA Norway will determine the extent of the transboundary impact the Project will have at all stages.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Creation of an aviation obstacle environment	Decommissioning	C-16, C-18, C-33, C-34, C-38, C-39, C-40	Possible likely significant effect without secondary mitigation - **Scoped In**	Construction and decommissioning of the wind farm may involve tall crane vessels creating a physical obstruction. The presence of WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs and associated obstructions will have a potential impact on military low flying aircraft, Sumburgh Airport IFPs, helicopter traffic in support of offshore oil and gas, and SAR operations. An IFP assessment will be necessary to determine if the Offshore Proposed Development will impact Sumburgh Airport IFPs.
Increased air traffic in the area related to wind farm activities	Decommissioning	C-16, C-18, C-33, C-34, C-38, C-39, C-40	Possible likely significant effect without secondary mitigation - **Scoped In**	Helicopter traffic involved in all stages of the Project could affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing traffic will include low flying aircraft and helicopters in support of the oil and gas industry.
Transboundary impact	Decommissioning	C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The Array Areas infringe Polaris FIR airspace regulated by CAA Norway. Consultation with CAA Norway will determine the extent of the transboundary impact the Project will have at all stages.
Effects on civil and military SSR systems	Construction, Operation and Maintenance, and Decommissioning.	N/A	No likely significant affect at Scoping - **Scoped Out**	CAP 764 states that the effects on SSR *"…are typically only a consideration when the turbines are located very close to the SSR i.e., less than 10 km"*. The nearest SSR facility is located at Fitful Head, 52.3 km to the southwest of the Array Areas. NATS do not consider the effects of WTGs on SSR to be material or relevant for WTGs that are beyond approximately 28 km from the nearest SSR facility.
Effects on weather radars	Construction, Operation and Maintenance, and Decommissioning.	N/A	No likely significant affect at Scoping - **Scoped Out**	The nearest Met Office Radar is the Hill of Dudwick, located 314 km from the closest extent of the Array Areas. Preliminary RLoS analysis indicates that WTGs with a maximum tip height of 347 m AMSL within the Offshore Proposed Development Array Areas will not be visible to the Hill of Dudwick.

10 Shipping and Navigation

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Vessel displacement	Construction and Decommissioning	C-3, C-9, C-14, C-22, C-24, C-33, C-34, C-39	Possible likely significant effect without secondary mitigation - **Scoped In**	Third-party vessels may be displaced from their existing routes due to construction/decommissioning and O&M activities associated with the Offshore Proposed Development resulting in increased journey times and distances. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.
Increased vessel to vessel collision risk (third party to third party)	Construction and Decommissioning	C-3, C-9, C-10, C-13, C-14, C-16, C-22, C-24, C-34, C-35	Possible likely significant effect without secondary mitigation - **Scoped In**	Vessels may be displaced or required to alter routes due to the presence of the Offshore Proposed Development or buoyed construction/ decommissioning area and may result in an increased number of third-party vessel encounters and consequently an increased third-party vessel collision risk. Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop.
Increased vessel to vessel collision risk (third party to project vessel)	Construction and Decommissioning	C-3, C-9, C-10, C-13, C-14, C-16, C-22, C-24, C-26, C-27, C-34, C-35	Possible likely significant effect without secondary mitigation - **Scoped In**	The increased levels of vessel traffic in the area associated with the construction, operation and maintenance, and decommissioning of the Offshore Proposed Development may lead to increased collision risk between a third party and project vessel. Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop.
Reduced access to local ports	Construction and Decommissioning	C-1, C-3, C-9, C-13, C-14, C-22, C-26, C-27, C-35	Possible likely significant effect without secondary mitigation - **Scoped In**	Access to local ports, in particular Lerwick, may be impacted due to construction/decommissioning and maintenance activities associated with the Offshore Proposed Development. The extent of the impact will depend on the final landfall location chosen for the Offshore ECC. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.
Creation of vessel to structure allision risk	Operation and Maintenance	C-2, C-3, C-9, C-13, C-16, C-22, C-24, C-26, C-33, C-34, C-39, C-40, C-43	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of surface structures will create new allision risk for powered vessels, drifting vessels and any vessels navigating between and internally within the Array Areas Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop.
Loss of station	Operation and Maintenance	C-3, C-9, C-19, C-16, C-22, C-24, C-33, C-43	Possible likely significant effect without secondary mitigation - **Scoped In**	Should a mooring system failure occur, a floating structure may lose station and become a floating hazard to passing vessels. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Reduction in under-keel clearance	Operation and Maintenance	C-1, C-3, C-9, C-22, C-33, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of subsea infrastructure including mooring lines, buoyant inter-array cables, or cable protection may increase under-keel interaction risk. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.
Anchor or gear interaction with mooring lines or subsea cables	Operation and Maintenance	C-1, C-10, C-22, C-24, C-33, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The presence of mooring lines and subsea cables may lead to an increase in the risk of anchor or fishing gear interaction. This impact will be considered in the NRA in relation to navigational safety only, i.e., effects on active fishing activity will be considered as part of the commercial fisheries assessment. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.
Interference with navigation, communications, and position-fixing equipment	Operation and Maintenance	C-1, C-16, C-22, C-33, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development infrastructure (e.g., wind turbine generators (WTGs), subsea cables) may impact equipment onboard vessels, including potential effects of electromagnetic interference from cables. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.
Reduction of emergency response capability including SAR	Operation and Maintenance	C-2, C-9, C-13, C-16, C-24, C-26, C-27, C-33	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development infrastructure and associated activities may reduce emergency response capability due to an increased number of incidents and/or access constraints, including in relation to SAR. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.
Vessel displacement	Operation and Maintenance	C-3, C-9, C-16, C-22, C-24, C-33, C-34, C-39	Possible likely significant effect without secondary mitigation - **Scoped In**	Third-party vessels may be displaced from their existing routes due to construction/decommissioning and O&M activities associated with the Offshore Proposed Development resulting in increased journey times and distances. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.
Increased vessel to vessel collision risk (third party to third party)	Operation and Maintenance	C-3, C-10, C-13, C-16, C-22, C-24, C-33, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	Vessels may be displaced or required to alter routes due to the presence of the Offshore Proposed Development or buoyed construction/ decommissioning area and may result in an increased number of third-party vessel encounters and consequently an increased third-party vessel collision risk. Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Increased vessel to vessel collision risk (third party to project vessel)	Operation and Maintenance	C-3, C-9, C-10, C-13, C-16, C-22, C-24, C-26, C-27, C-34	Possible likely significant effect without secondary mitigation - **Scoped In**	The increased levels of vessel traffic in the area associated with the construction, operation and maintenance, and decommissioning of the Offshore Proposed Development may lead to increased collision risk between a third party and project vessel. Desk Study, Stakeholder Consultation, Anatec COLLRISK Model and Hazard Review Workshop.
Reduced access to local ports	Operation and Maintenance	C-1, C-3, C-9, C-13, C-22, C-26, C-27	Possible likely significant effect without secondary mitigation - **Scoped In**	Access to local ports, in particular Lerwick, may be impacted due to construction/decommissioning and maintenance activities associated with the Offshore Proposed Development. The extent of the impact will depend on the final landfall location chosen for the Offshore ECC. Desk Study, Stakeholder Consultation, and Hazard Review Workshop.

11 Marine Archaeology and Cultural Heritage

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Loss of, or damage to, known and unknown marine historic environment assets from direct impacts (intertidal, seabed prehistory, maritime and aviation archaeology).	Construction & Decommissioning	C-1, C-14, C19, C-37	Possible likely significant effect without secondary mitigation - **Scoped In**	Construction of the Offshore ECC and other infrastructure that impact on the seabed have the potential to result in the damage/loss of known archaeological features and unknown archaeological features, which may lie undiscovered on or below the surface of the seabed, if any are present. Similar effects may be expected from vessel jack-up or anchoring systems that impact the seabed, or the removal of devices and other infrastructure in ways that disturb the seabed during decommissioning activities. Effects are considered to be permanent. Archaeological assessment of marine geophysical and geotechnical datasets to establish the baseline character for marine archaeology and cultural heritage receptors.
Indirect disturbance to marine historic environment assets caused by cable burial methods and /or cable protection	Construction & Decommissioning	C-1, C-14, C-19, C-20, C-37	Possible likely significant effect without secondary mitigation - **Scoped In**	Indirect impacts to known and potential seabed prehistory, maritime and aviation assets caused by changes to the hydrodynamic and sedimentary regimes due to sediment redistribution. Review of Seabed Processes assessment and archaeological assessment of marine geophysical and geotechnical datasets to establish the baseline character for marine archaeology and cultural heritage receptors.
Loss of or damage to known and unknown marine historic environment assets from direct impacts (intertidal, seabed prehistory, maritime and aviation archaeology)	Operation and Maintenance	C-17, C-19. C-37	Possible likely significant effect without secondary mitigation - **Scoped In**	Any of the device designs, cables and other infrastructure on the seabed or in the water column above that result in localised scouring have the potential to result in the damage/loss of known and unknown archaeological features lying on the seabed, if such assets are shown to be present. Maintenance vessel jack-up or anchoring systems that impact the seabed, or the repeated removal and replacement of devices and other infrastructure in ways that disturb the seabed also have the potential to result in the damage/loss of any archaeological features lying on the seabed. Effects are considered to be permanent. Assessment conducted prior to Construction phase above.
Indirect disturbance to marine historic environment assets caused by additional cable protection used during repair and maintenance	Operation and Maintenance	C-17, C-19, C-20, C-37	Possible likely significant effect without secondary mitigation - **Scoped In**	Indirect changes to known and potential seabed prehistory, maritime and aviation assets caused by changes to hydrodynamic and sedimentary regimes may expose receptors leading to increased rates of deterioration through biological, chemical and physical processes. Assessment conducted prior to Construction phase above.

12 Other Marine Users and Infrastructure

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Temporary obstruction to other OWFs	Construction and Decommissioning	C-1; C-4; C-10; C-22; C-24; C-27; C-30.	Possible likely significant effect without secondary mitigation - **Scoped In**	The study area overlaps with the array areas and potential ECC of the Stoura OWF (currently unknown). Thus, there is potential to obstruct activities necessary to their development or the need to cross their offshore export cables. Desktop study supported by consultation with stakeholders.
Temporary obstruction to tidal renewable energy activities and developments	Construction and Decommissioning	C-4; C-10; C-22; C-27.	Possible likely significant effect without secondary mitigation -Scoped In	The study area overlaps with one or more tidal renewable energy projects. Thus, there is potential to obstruct activities necessary to their development or the need to cross their offshore export cables. Desktop study supported by consultation with stakeholders.
Temporary obstruction to subsea cables and utilities activities and developments	Construction and Decommissioning	C-1; C-10; C-18; C-22; C-24; C-28; C-30.	Possible likely significant effect without secondary mitigation - **Scoped In**	The study area overlaps with telecommunication cables and power cables that connect the Shetland Isles. Therefore, there is potential for disruption to the activities of this development. Desktop study supported by consultation with stakeholders.
Temporary obstruction to marine dredging and disposal activities	Construction and Decommissioning	C-1; C-4; C-22; C-27; C-28.	Possible likely significant effect without secondary mitigation - **Scoped In**	There are two open dredge spoil deposit sites within the Offshore Proposed Development boundary. And OMUI study area. There is potential for disruption to the activities of this development. Desktop study supported by consultation with stakeholders.
Temporary obstruction to Oil and Gas activities and developments	Construction and Decommissioning	C-10; C-16; C-18; C-22; C-24; C-27; C-30.	Possible likely significant effect without secondary mitigation - **Scoped In**	Due to the proximity to the O&G subsea pipelines and terminals on Shetland mainland there is potential for disruption to the activities of this development. Desktop study supported by consultation with stakeholders.
Temporary obstructions to aquaculture activities	Construction and Decommissioning	C-4; C-8; C-9; C-22.	Possible likely significant effect without secondary mitigation - **Scoped In**	There are 188 aquaculture sites within the study area, thus, there is potential for disruption to these activities. Desktop study supported by consultation with stakeholders.
Temporary obstruction to other OWFs	Operation and Maintenance	C-1; C-4; C-10; C-22; C-24; C-27; C-30.	Possible likely significant effect without secondary mitigation - **Scoped In**	The study area overlaps with the array area and potential ECC of the Stoura OWF (currently unknown). Thus, there is potential to obstruct activities necessary to their development or the need to cross their offshore export cables. Desktop study supported by consultation with stakeholders.

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Temporary obstructions to INTOG	Construction & Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	There are no INTOG developments within the study area.
Temporary obstructions to Wave Energy projects	Construction & Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	There are no wave energy projects within the study area.
Temporary obstructions to CCS	Construction & Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	There are no CCS activities within the study area.
Temporary obstructions to Nuclear projects	Construction & Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	There are no nuclear activities within the study area.

13 Socioeconomics, Tourism and Recreation

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Increase in employment and GVA	Construction, Operation and Maintenance and Decommissioning	Supply Chain Development Statement and wider stakeholder engagement	Possible likely significant effect without secondary mitigation - **Scoped In**	Economic impacts associated with the expenditure of the Offshore Proposed Development and supply chain requirements. Desk based assessment
Demographic changes	Construction, Operation and Maintenance and Decommissioning	N/A	Possible likely significant effect without secondary mitigation - **Scoped In**	Change in population and characteristics of population as a result of the Offshore Proposed Development. Desk based assessment
Changes to housing demand	Construction, Operation and Maintenance and Decommissioning	Stakeholder engagement, including with local authorities and sector bodies.	Possible likely significant effect without secondary mitigation - **Scoped In**	Change in level of demand for accommodation as a result of the Offshore Proposed Development and its demographic impacts. Desk based assessment
Changes to other local public and private services	Construction, Operation and Maintenance and Decommissioning	Stakeholder engagement, including with local authorities and sector bodies.	Possible likely significant effect without secondary mitigation - **Scoped In**	Change in level of demand for services as a result of the Offshore Proposed Development and its demographic impacts. Desk based assessment
Changes to commercial fisheries	Construction, Operation and Maintenance and Decommissioning	Proposed embedded mitigation are outlined in Chapter 13: Commercial Fisheries	Possible likely significant effect without secondary mitigation - **Scoped In**	Potential disruption to the commercial fishing sector leading to changes in economic activity in the sector, including to upstream and downstream supply chains. Desk based assessment
Changes to tourism receptors.	Construction, Operation and Maintenance and Decommissioning	N/A	Possible likely significant effect without secondary mitigation - **Scoped In**	The construction of the Offshore Proposed Development has the potential to influence visitor behavior, depending on the other environmental impacts that are generated. Desk based assessment/

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
Changes to shipping and marine recreation	Construction, Operation and Maintenance and Decommissioning	Proposed embedded mitigation are outlined in Chapter 15: Shipping and Navigation and Chapter 17 Other Marine Users and Infrastructure, including C-10, C-13, C16, C-22 and C-27	Possible likely significant effect without secondary mitigation - **Scoped In**	Changes to economic activity as a result of the Offshore Proposed Development may affect activity in the shipping and marine recreation sectors. Desk based assessment
Sociocultural	Construction, Operation and Maintenance and Decommissioning	N/A	No likely significant affect at Scoping - **Scoped Out**	It is proposed that the sociocultural effects, identified in the General Advice as a potential area of impact, are scoped out of EIA. This includes: Lifestyles/quality of life; gender issues; family structure; social problems (e.g. crime, ill-health, deprivation); human rights; community stress and conflict; integration, cohesion, and alienation; and community character or image.

14 Climate Change and Greenhouse Gas

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
GHG emissions associated with construction materials (raw material supply, transportation, and manufacture)	Construction	C-4; C-6; C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development will lead to generation of GHG emissions during construction in relation to the construction materials. GHG Assessment.
GHG emissions associated with construction processes including transportation to site and installation processes.	Construction	C-4; C-6; C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development will lead to generation of GHG emissions during construction/installation. GHG Assessment.
CCR of construction period	Construction	C-4; C-6; C-12; C-14	Possible likely significant effect without secondary mitigation - **Scoped In**	There is potential for anticipated changes to climate (such as extreme weather events) to negatively impact the Offshore Proposed Development during construction and decommissioning. CCR Assessment.
ICCI of construction period	Construction	C-4; C-6; C-12; C-14	Possible likely significant effect without secondary mitigation - Scoped In	The Offshore Proposed Development has potential to be negatively impacted by significant climate change effects during construction and decommissioning. ICCI Assessment
GHG emissions associated with operation including energy use	Operation and maintenance	C-6; C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The generation of low carbon electricity during the O&M phase will be supported by the Offshore Proposed Development, but the net benefits against a future baseline will be assessed. GHG Assessment
GHG emissions that are associated with maintenance including materials used for repair and replacement activities	Operation and maintenance	C-6; C-12	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development will lead to generation of GHG emissions during maintenance activities associated with material replacement and repair activities. GHG Assessment
CCR of operations period	Operation and maintenance	C-6; C-12.	Possible likely significant effect without secondary mitigation -**Scoped In**	Changes of climate that are anticipated (like extreme weather events) may negatively impact the Offshore Proposed Development during O&M. CCR Assessment

Impact Background			EIA Scoping	
Impact	**Project phase**	**Commitments**	**Likely Significant Effect at Scoping (LSE, Possible LSE, No LSE)**	**Justification / Approach to assessment**
ICCI of operations period	Operation and maintenance	C-6; C-12.	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development has potential to be negatively impacted. ICCI Assessment
GHG emissions associated with decommissioning processes including transportation	Decommissioning	C-6; C-14	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development will lead to generation of GHG emissions during decommissioning. GHG Assessment
CCR of construction and decommissioning period	Decommissioning	C-4; C-6; C-12; C-14	Possible likely significant effect without secondary mitigation - **Scoped In**	There is potential for anticipated changes to climate (such as extreme weather events) to negatively impact the Offshore Proposed Development during construction and decommissioning. CCR Assessment
ICCI of construction and decommissioning period	Decommissioning	C-4; C-6; C-12; C-14	Possible likely significant effect without secondary mitigation - **Scoped In**	The Offshore Proposed Development has potential to be negatively impacted by significant climate change effects during construction and decommissioning. ICCI Assessment

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OFFSHORE WIND FARM