Green Volt Offshore windfarm - Offshore Environmental Impact Assessment

Offshore Scoping Report

Client: Flotation Energy

Reference: PC2483-RHD-ZZ-XX-RP-Z-0001

Status: S0/P01.01

Date: 15 November 2021

Royal HaskoningDHV
Enhancing Society Together

FLOTATION ENERGY

HASKONINGDHV UK LTD.

74/2 Commercial Quay
Commercial Street
Leith
Edinburgh
EH6 6LX
United Kingdom
Industry & Buildings
VAT registration number: 792428892

+44 131 5550506 **T**
info.edinburgh@uk.rhdhv.com **E**
royalhaskoningdhv.com **W**

Document title:	Green Volt Offshore windfarm - Offshore Environmental Impact Assessment
Document short title:	
Reference:	PC2483-RHD-ZZ-XX-RP-Z-0001
Status:	P01.01/S0
Date:	15 November 2021
Project name:	Green Volt Offshore windfarm
Project number:	PC2483

Classification
Open

Revision history

Revision	Date	Description	Prepared	Checked	Approved
1	22nd October 2021	Internal Draft to go to Flotation Energy	Catriona Munro & Sam Freeman		
2	3rd November 2021	Internal Draft to go to Flotation Energy	Catriona Munro & Sam Freeman	Alexia Chapman	
3	15th November 2021	Final to go to Flotation Energy	Catriona Munro & Sam Freeman	Alexia Chapman	

Contents

Table of Tables

Table of Figures

Annexes

Annex A – Proposed Consultation List

Acronyms / Abbreviations

Acronyms	Description
AC	Alternating Current
AD	Air Defence
ADD	Acoustic Deterrent Device
ADBA	Archaeological Desk-Based Assessment
AEZ	Archaeological Exclusion Zone(s)
AfL	Area for Lease
AIS	Automatic identification system
ANO	UK Air Navigation Order
AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
ASFB	Atlantic Salmon Fisheries Board
ATC	Air Traffic Control
ATS	Air Traffic Services
BAP	Biodiversity Action Plan
BEIS	The Department for Business, Energy and Industrial Strategy
BGS	British Geological Surveys
BODC	British Oceanographic Data Centre
BPD	Barrels Per Day
CAA	Civil Aviation Authority
CANMORE	National Record of The Historic Environment
CAP	Civil Aviation Publication
CEFAS	Centre for Environment, Fisheries and Aquaculture
CES	Crown Estate Scotland
CFD	Contract for Difference
CGNS	Celtic and Greater North Seas
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CoS	Chamber of Shipping
COWRIE	Collaborative Offshore Wind Research into the Environment
CPEL	CNOOC Petroleum Europe Ltd
CPI	Carbon Preference Index
DC	Direct Current
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DGC	Defence Geographic Centre
DoL	Depth of Lowering
DPO	Draft Plan Option
DSFB	District Salmon Fishery Boards
EC	European Commission
EEA	European Economic Area
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field(s)
EMODnet	European Marine Observation and Data Network
EMS	Environmental Management System(s)
EPP	Evidence Plan Process
EPS	European Protected Species
ERRV	Emergency Response and Rescue Vessel
ES	Environmental Statement
ESAS	European Seabirds at Sea
ETG	Expert Topic Group

EU	European Union
EUNIS	European Nature Information System
FID	Final Investment Decision
FOC	Fractionated Organic Carbon
FPSO	Floating Production Storage Offloading
FSA	Formal Safety Assessment
GBP	British Pound Sterling
GNS	Greater North Sea
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HES	Historic Environment Scotland
HM	Her Majesty's
Hmax	Maximum Wave Height (metres)
HRA	Habitats Regulations Appraisal
HS	Wave Height
HSE	Health & Safety Executive
HV	High Voltage
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IAMMWG	Inter-Agency Marine Mammal Working Group
ICAO	International Civil Aviation Organization
ICES	International Council for the Exploration of the Sea
ICOPES	Inductively coupled plasma optical emission spectrometry
ICPMS	Inductively coupled plasma mass spectrometry
IHLS	International Herring Larvae Survey
IMO	International Maritime Organization
INTOG	Innovation and Targeted Oil and Gas
IUCN	International Union for Conservation of Nature
JCP	Joint Cetacean Protocol
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
KIS-ORCA	Kingfisher Information Service - Offshore Renewable & Cable Awareness
LAT	Lowest Astronomical tide
LMP	Lighting and Marking Plan
LoS	Line of Sight
LSE	Likely Significant Effect
MAIB	Marine Accident Investigation Branch
MarLIN	Marine Life Information Network
MBES	Multi Beam Echosounder
MCA	Maritime & Coastguard Agency
MEDIN	Marine Environmental Data and Information Network
MGN	Marine Guidance Note
MHW	Mean High Water
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMA	Military Aviation Authority
MMMP	Marine Mammal Mitigation Plan
MMO	Marine Management Organisation
MOD	Ministry of Defence
MPA	Marine Protected Area
MRE	Marine Renewable Energy
MS	Marine Scotland
MSS	Marine Scotland Sciences
MSL	Mean Sea Level
MS-LOT	Marine Scotland – Licensing Operations Team
MU	Management Unit

MW	Megawatt
N/A	Not Applicable
NAMMCO	North Atlantic Marine Mammal Commission
NATS	National Air Traffic Services
NBN	National Biodiversity Network
NLB	Northern Lighthouse Board
NPF3	National Planning Framework 3
NPS	National Policy Statement
NRA	Navigation Risk Assessment
O&G	Oil and Gas
O&M	Operation & Maintenance
OfTI	Offshore Transmission Infrastructure
OGA	Oil and Gas Authority
OMFE	Outer Moray Firth Electrification
OnTI	Onshore Transmission Infrastructure
OREI	Offshore Renewable Energy Installations
ORJIP	Offshore Renewables Joint Industry Programme
OSP	Offshore Substation Platform(s)
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo Paris Convention)
OWF	Offshore Windfarm
PAC	Pre-Application Consultation
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
Phi	Sediment Grain Size (Phi Scale)
PMF	Priority Marine Feature
PSR	Primary Surveillance Radar
PTS	Permanent Auditory Injury
RAF	Royal Airforce
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
ROV	Remotely Operated Vehicle
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAR	Search and Rescue
SBP	Sub Bottom Profiler
SCANS-III	Small Cetaceans in the European Atlantic and North Sea
SCOS	Special Committee on Seals
SEA	Strategic Environmental Assessment
SEPA	Scottish Environmental Protection Agency
SFF	Scottish Fisherman's Federation
SLVIA	Seascape, Landscape and Visual Impact Assessment
SMRU	Sea Mammal Research Unit
SOLAS	Safety of Life at Sea
SOWEC	Scottish Offshore Wind Energy Council's
SPA	Special Protection Area
SPP	Scottish Planning Policy
SSC	Suspended Sediment Concentrations
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
STMPA	Southern Trench Marine Protected Area
THC	Total Hydrocarbon Concentration(s)
TLP	Tension Leg Platform
TOM	Total Organic Matter
UK	United Kingdom
UKDMAP	United Kingdom Digital Marine Atlas
UKHO	UK Hydrographic Office

UKOOA	UK Offshore Operators Association
UXO	Unexploded Ordnance
VMS	Vessel Monitoring Systems
WTG	Wind Turbine Generator(s)
ZTV	Zone of Theoretical Visibility

Executive Summary

This Scoping Report has been prepared in order to support a request for a formal Scoping Opinion in relation to the Green Volt Offshore Windfarm from Scottish Ministers. The Applicant, Green Volt Offshore Wind Ltd (Green Volt), intends to submit separate consents, licences and permissions for the offshore (below Mean High Water Springs (MHWS)) and onshore (above Mean Low Water Springs (MLWS)) infrastructure of the project. A separate onshore scoping report has been prepared for the onshore infrastructure.

Green Volt Offshore Windfarm is being proposed as the first major step towards the goals of the UK North Sea Transition Deal, a sector deal between the oil and gas industry and UK government, signed in March 2021. This Deal recognises that oil and gas will continue to play an essential role in our energy supply as part of the transition towards Net Zero and that it is, therefore critical, to reduce the CO_2 emissions generated by offshore oil and gas production from the earliest possible time point, with a minimum reduction of 50% by 2030.

To be operational by 2026, Green Volt offers the opportunity to mitigate 500,000 tonnes of CO_2 per year and fully electrify Buzzard, one of the UK's largest oil and gas assets. The opportunity is being evaluated in partnership with CNOOC Petroleum Europe Ltd (CPEL), the operator and largest shareholder in the Buzzard field and would enable removal of the offshore power station, which currently fuels oil and gas production from the field. With a dedicated grid connection, Green Volt Offshore Windfarm would also provide renewable energy to Scotland for decades to come and accelerate Scotland's path towards being a global leader in floating wind capability by creating the world's largest offshore floating windfarm.

Green Volt is proposing the development of the Green Volt Offshore windfarm on a brownfield site previously hosting the Ettrick and Blackbird oil field, 75 km east of the Aberdeenshire coast. One export cable would supply the Buzzard oil field 15 km away, whilst a second export cable would supply the National Grid, making landfall near Peterhead.

This Scoping Report considers all offshore infrastructure seaward of MHWS, notably:

- wind turbine generators, floating substructures, moorings, inter-array cables, electrical substation;
- export cables; and
- landfall onshore/offshore interface for the export to shore cable.

The offshore consents, licences and permissions which will be sought by the Applicant for the Green Volt Offshore windfarm are:

- a Section 36 consent under the Electricity Act 1989;
- a marine licence under the Marine and Coastal Access Act 2009; and
- a marine licence under the Marine (Scotland) Act 2010 for the part of the export cable which is within 12 nm of the coast.

An EIA Report is required in support to the applications for these consents, licences and permissions. The Offshore EIA Report will be informed by the Scoping Opinion on this Scoping Report. This Scoping Report identifies potentially significant environmental effects that will considered for further assessment in the EIA Report. The report provides an overview of the existing physical, biological and human environment, identified by known and accessible data sources, and outlines survey plans to obtain additional data where needed. An overview of both project-specific and cumulative potential effects associated with the construction, operation & maintenance, and decommissioning phases of the Green Volt Offshore Windfarm. This Scoping Report also outlines the proposed methods for assessment of the significance of effect on technical topics. The following technical topics have been considered:

Offshore Physical Environment

- Bathymetry
- Geology, geomorphology and offshore sediments
- Metocean conditions
- Water quality
- Sediment quality
- Air quality

Offshore Biological Environment

- Benthic and Intertidal Ecology
- Fish and Shellfish
- Marine Mammals
- Ornithology

Offshore Human Environment

- Seascape, Landscape and Visual Resources
- Shipping and Navigation
- Commercial Fisheries
- Marine Archaeology and Cultural Heritage
- Offshore Social-Economics and Tourism
- Infrastructure and Other Marine Users
- Civil Aviation, Military, Unexploded Ordnance and Communication
- Human Health

Further to this, a description of the location of Green Volt Offshore windfarm and the site selection process will also be outlined in this report as well as the underpinning purpose of the Project. Consultees are invited to consider all of the information provided in this Scoping Report and to provide comments on the proposed approach and in particular whether they agree with the conclusions drawn.

1 Introduction

1.1 Purpose of this Report

This Scoping Report has been prepared in order to support a request for a formal Scoping Opinion in relation to the Green Volt Offshore Windfarm from Scottish Ministers. The Applicant, Green Volt Offshore Wind Ltd (Green Volt), intends to submit separate consents, licences and permissions for the offshore (below Mean High Water Springs (MHWS)) and onshore (above Mean Low Water Springs (MLWS)) infrastructure of the project. A separate onshore scoping report has been prepared for the onshore infrastructure. The offshore components of the project are hereafter referred to as the Project.

As Green Volt proposes a generating station greater than 1 MW, it requires the following consent and licences for the offshore infrastructure:

- a Section 36 (s.36) consent under the Electricity Act (1989, as amended); and
- a marine licence under the Marine and Coastal Access Act 2009 (for infrastructure outside of 12 nautical miles (nm)) and Marine (Scotland) Act 2010 (for infrastructure inside of 12 nm).

This scoping report identifies the main considerations that will be addressed during the Environmental Impact Assessment (EIA) and aims to outline a structure for consultation on the approach to the EIA and the content of the EIA Report that will be produced to accompany the s.36 and marine licence applications. It further provides details of the key issues anticipated and outlines methodologies for the various impact assessments; however, it is also acknowledged that the scope of the EIA may change as the project progresses and more information is accumulated and analysed.

Within this Scoping Report, a number of potential environmental impacts are considered. Receptors and impacts have been scoped in or out on the basis of lessons learned from a wide range of previous scoping opinions for offshore wind farms, recognising that a number of items cannot be scoped out until further information is known about the project and the existing environment. Agreement with key stakeholders will be sought to determine final impacts to be scoped in and scoped out of the EIA.

1.2 Project Background

The Green Volt Offshore windfarm is being developed by Green Volt Offshore Windfarm Ltd (herein referred to as Green Volt), a new company formed by Flotation Energy Plc (FE) and CNOOC Petroleum Europe Ltd (CPEL). The project proposes to develop a floating offshore windfarm to facilitate a first of its kind decarbonisation of the Oil and Gas industry through the complete electrification of the Buzzard oil and gas field (operated by CPEL; Figure 1.1) with the support of a fully connected UK grid connection back to the New Deer substation in Aberdeenshire.

The Buzzard oil field is one of the largest oil and gas development on the UK continental shelf. Although the UK is currently exploring opportunities to reduce dependency on oil and gas, over 75% of our primary energy supply today comes from oil and gas. The Buzzard field is one of the newer, more efficient, production facilities in the North Sea and is expected to be required to continue operation until late 2030's to early 2040's.

Figure 1.1: Buzzard oil and gas facility, with power generation chimneys visible on the leftmost platform.

Currently, the Buzzard platform incorporates its own power generation system to supply power for oil and gas processing, a gas lift system, water injection system and essential utilities. The total electrical demand for the platform would be a constant 70 MW, equivalent to the electrical demand for approximately 170,000 UK homes. As of today, the operation of Buzzard's onboard power generation system is responsible for the direct emission of approximately 300,000 tonnes of carbon dioxide (CO_2) per year.

As a major UK Oil and Gas facility with a large electrical load and long operating life, Buzzard presents an excellent opportunity to begin the decarbonisation of offshore oil and gas production. Figure 1.2 presents a simple overview. The platform is surrounded by high quality wind resource and the recent maturation of floating wind technology means that it is now possible to source the vast majority of electrical power required for Buzzard from offshore wind.

The proposed Green Volt offshore floating provides the means to achieve this, whilst simultaneously providing an opportunity to scale Scotland's and the UK's growing capability in floating wind. The project will include development of a major offshore floating windfarm, which will be connected to the UK grid. This solution provides a number of advantages:

- The windfarm would provide power to the oil field at the same level of reliability as the UK grid, improving the overall reliability of power to the platform.
- Retiring of the offshore power generation on Buzzard would mitigate at least 300,000 tonnes / year of CO_2 emissions from 2026 until the end of the Buzzard field life.
- Surplus power from the windfarm would be exported to the UK grid, providing enough renewable electricity to power at least 300,000 UK homes and mitigate an additional 200,000 tonnes of CO_2 emissions if used to modify the current mix of renewable / non-renewable power on the UK grid.
- The windfarm would be expected to outlast the Buzzard oil field and will provide renewable power to the UK grid for many decades to come.
- Green Volt would also stimulate Scotland's capability in floating wind, providing the means for rapid deployment of this important technology.

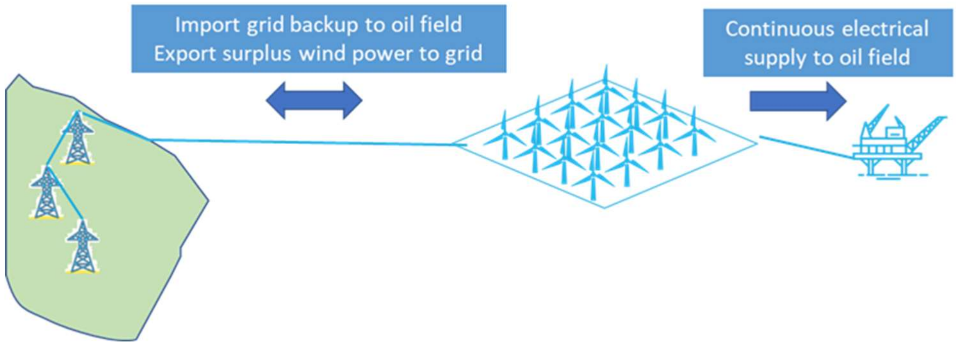


Figure 1.2 Project Overview

With the opportunity to complete construction and begin operation by 2026, Green Volt can significantly contribute to the North Sea Transition deal target of a 25% reduction in offshore emissions associated with oil and gas activity by 2027.

1.2.1 Floating Wind Capability

Green Volt would demonstrate the technological feasibility of using a floating offshore wind, at industrial output levels, to support the decarbonisation of the UK's North Sea oil and gas industry. The Green Volt Offshore windfarm would be the world's first and largest array of floating wind turbines to commercially support this process and will strengthen a leading position for Scotland in the development and deployment of floating wind technology. Green Volt Offshore windfarm embodies a bridging of the current divide between offshore renewables and the oil and gas sector.

Floating foundations open the possibility for future offshore windfarms to be located further from shore in the deeper waters of the Exclusive Economic Zone (EEZ), eliminating visual impacts from the Scottish coastline whilst accessing hitherto untapped wind resources. Floating structures also offer benefits over conventional fixed foundations in terms of reduced construction and installation costs, with limited use of very large offshore construction vessels at the development site and none of the extensive piling operations associated with a fixed offshore windfarm. Floating wind therefore also minimises potential noise impacts upon sea mammals during construction and installation phase of the development.

1.2.2 Project Area

The proposed project area is to be located on the decommissioned Ettrick and Blackbird oil and gas developments, which ceased production in 2017 and are still (as of 2021) undergoing final decommissioning activities. Ettrick and Blackbird fields are brownfield sites with large amounts of site data captured, including two EIA reports during previous oil and gas field construction, operation and decommissioning works. Green Volt aims to utilise this data to streamline EIA, Habitats Regulations Appraisal (HRA) and other associated consent submissions of the proposed windfarm.

In 2019, FE started the process of the identification of a suitable project development area to support the installation of a floating offshore wind for the purpose of supporting the decarbonisation of the oil and gas platforms in the North Sea. This process created the initial project concept for the Green Volt Project Area, which was based on the reviewed early phase scoping reports of the offshore wind energy draft sectoral marine plan strategic environmental assessment (SEA), where oil and gas areas were specifically excluded from the area of search in 2018 (Marine Scotland, 2018a). As part of the initial draft plan option (DPO) identification scoping work, it was identified that several oil and gas developments located in the area between DPO NE7 and E2 had been considered a hard constraint for offshore wind development and that these areas of search were removed from the overall sectoral marine plan process at an early stage.

The site selection process identified two potential project areas that were available for brownfield redevelopment and FE then undertook a high-level assessment to confirm which site development area should be taken forward for additional assessment. The key consideration for this review was the potential distances to surrounding oil platforms that had significant power requirements (demand) and long-term future operational life spans (at least 15 years). This review clearly showed that the Buzzard is a suitable oil platform to start the process of electrification with offshore wind power. Buzzard has a long remaining operating life, but it is also one of the largest platforms in the North Sea and is sufficiently close to land to enable an alternating current (AC) electrical connection to the UK grid.

Having selected Buzzard as a target consumer for electrical power, FE investigated a number of sites as candidates for installation of an offshore floating windfarm. Two sites were considered in detail – these were (i) the decommissioned Ettrick and Blackbird oil and gas field, 20 km from Buzzard and (ii) the decommissioned Buchan oil and gas field further east (Figure 1.3

Figure 1.3). It has been subsequently noted that a new, smaller scale development will be located at the old Buchan oil field which is scheduled to become active within the next decade; therefore, rendering this site unsuitable for the development of an offshore windfarm. This site selection review also identified the following key advantages for the Ettrick and Blackbird site:

- located 20 km away from the Buzzard platform complex;
- a brown field development area with significant and long-term environmental data sets;
- significant site geotechnical and geophysical data set availability to minimise future survey requirements and accelerate site development activities;
- water depth (100 -115 m) is suitable for the deployment of floating wind turbine substructures fitted with the next generation of offshore turbines (>10 MW);
- average mean wind speed of 10.93 m/s (UK Offshore Wind Resource Dataset 2015 – Hindcast of 30-year average at 110 m above sea level by The MetOffice) (The Crown Estate, 2015); and
- fishing activity at the site is very limited.

The site boundaries will be selected from within the area identified in the Area for Lease (AfL) applied for through Crown Estate Scotland (CES) Innovation and Targeted Oil and Gas (INTOG) leasing round. The site will cover a relatively small area, approximately 144 km^2, but further engineering assessments will be required to confirm the area and optimum layout once turbine and foundation selection have been made.

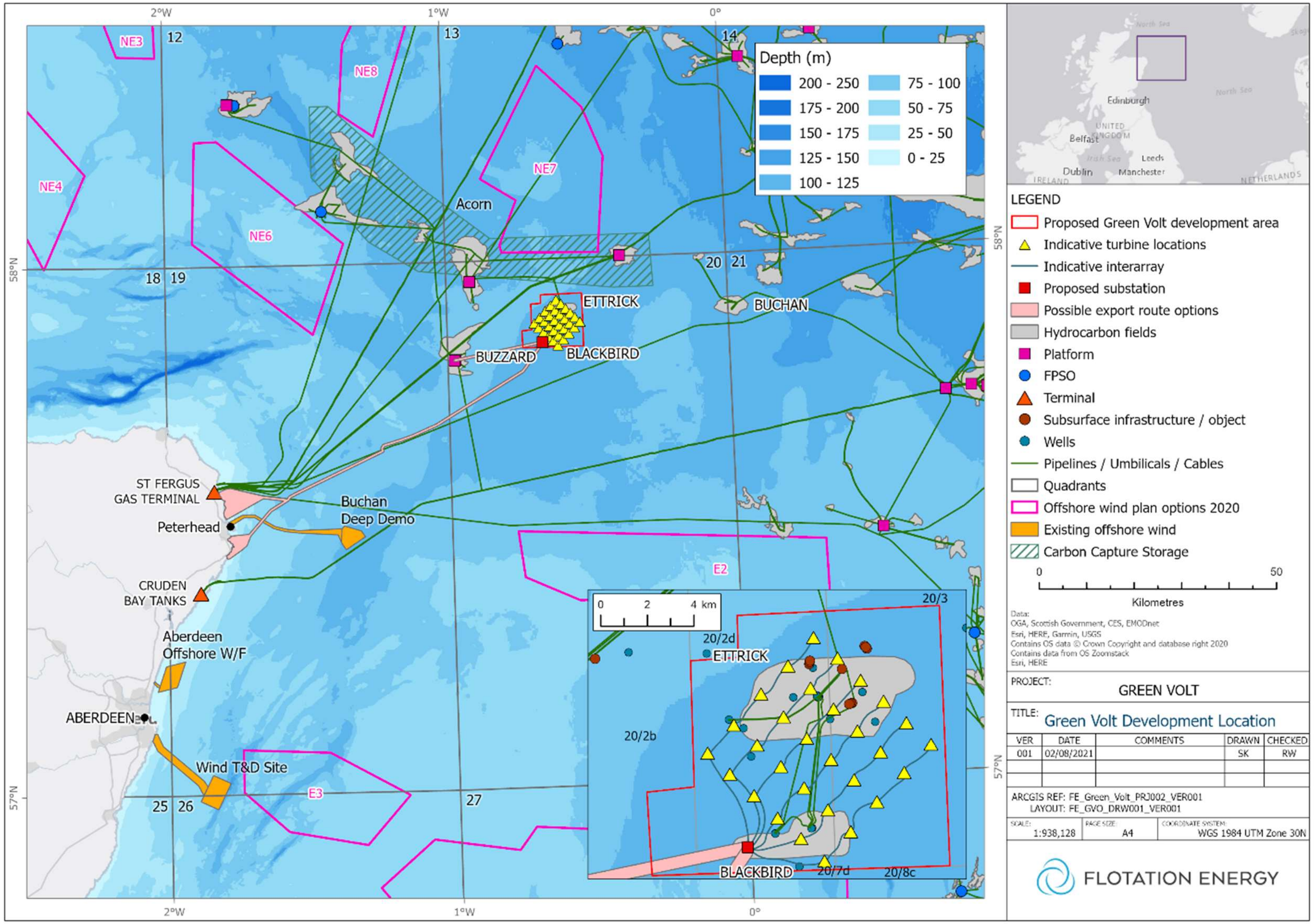


Figure 1.3 Green Volt Offshore Windfarm Location

1.2.3 North Sea Transition Deal

The North Sea Transition Deal agreed between the UK Government and UK oil and gas industry was announced in March 2021. The sector deal between the UK government and oil and gas industry will support workers, businesses, and the supply chain through the transition to a low carbon future by harnessing the industry's existing capabilities, infrastructure and private investment potential to exploit new and emerging technologies such as hydrogen production, Carbon Capture Usage and Storage, offshore wind and decommissioning.

Key commitments in the North Sea Transition Deal include:

- the sector setting early targets to reduce emissions by 10% by 2025 and 25% by 2027 and has committed to cut emissions by 50% by 2030
- joint government and oil and gas sector investment of up to £16 billion by 2030 to reduce carbon emissions. This includes up to £3 billion to replace fossil fuel-based power supplies on oil and gas platforms with renewable energy.

Power generation accounts for around two thirds of oil and gas production emissions. It is anticipated that powering installations using electricity either from a cable to the shore or from a nearby windfarm, could lead to two to three million tonnes per annum of CO_2 emissions reductions, which is equivalent to the annual carbon emissions from households in a city the size of Liverpool.

Platform electrification is a key component of the Oil and Gas Authority's (OGA's) vision for an integrated energy basin. The OGA's Energy Integration Report[1] found that the UK Continental Shelf could (through a mix of platform electrification, carbon capture and storage, offshore wind and hydrogen) absorb up to 60% of the UK's entire CO_2 abatement needed to achieve net zero emissions by 2050.

In September 2019, OGA Chief Executive Dr Andy Samuel said: "Electrification of oil and gas installations is a vital part of industry's licence to operate and to meet its North Sea Transition Deal emissions reduction targets. This is also a big opportunity for industry to support offshore wind expansion, with lasting infrastructure that will provide benefits beyond oil and gas, long into the future."

CPEL is leading the Outer Moray Firth Electrification (OMFE) group, supported by Harbour, Repsol Sinopec and Ithaca Energy, to screen supply and gridding options for assets in the Outer Moray Firth region of the UK North Sea.

Green Volt would directly contribute to the early targets for emissions reduction set out in the North Sea transition deal by making 100% renewable power available for Buzzard and could form the basis for future developments to power a wider offshore grid. The concept has strong alignment with the OGA's position on platform electrification and infrastructure integration.

1.2.4 Crown Estate Scotland's Innovation Targeted Oil and Gas (INTOG) Decarbonisation Leasing

In August 2021, Crown Estate Scotland announced the INTOG leasing round, which will take place in early 2022. INTOG has been designed to allow developers to apply for the rights to build offshore windfarms specifically for the purpose of providing low carbon electricity to power oil and gas installations and help to decarbonise the sector (Figure 1.4).

---

[1] *https://www.ogauthority.co.uk/news-publications/publications/2020/ukcs-energy-integration-final-report/*

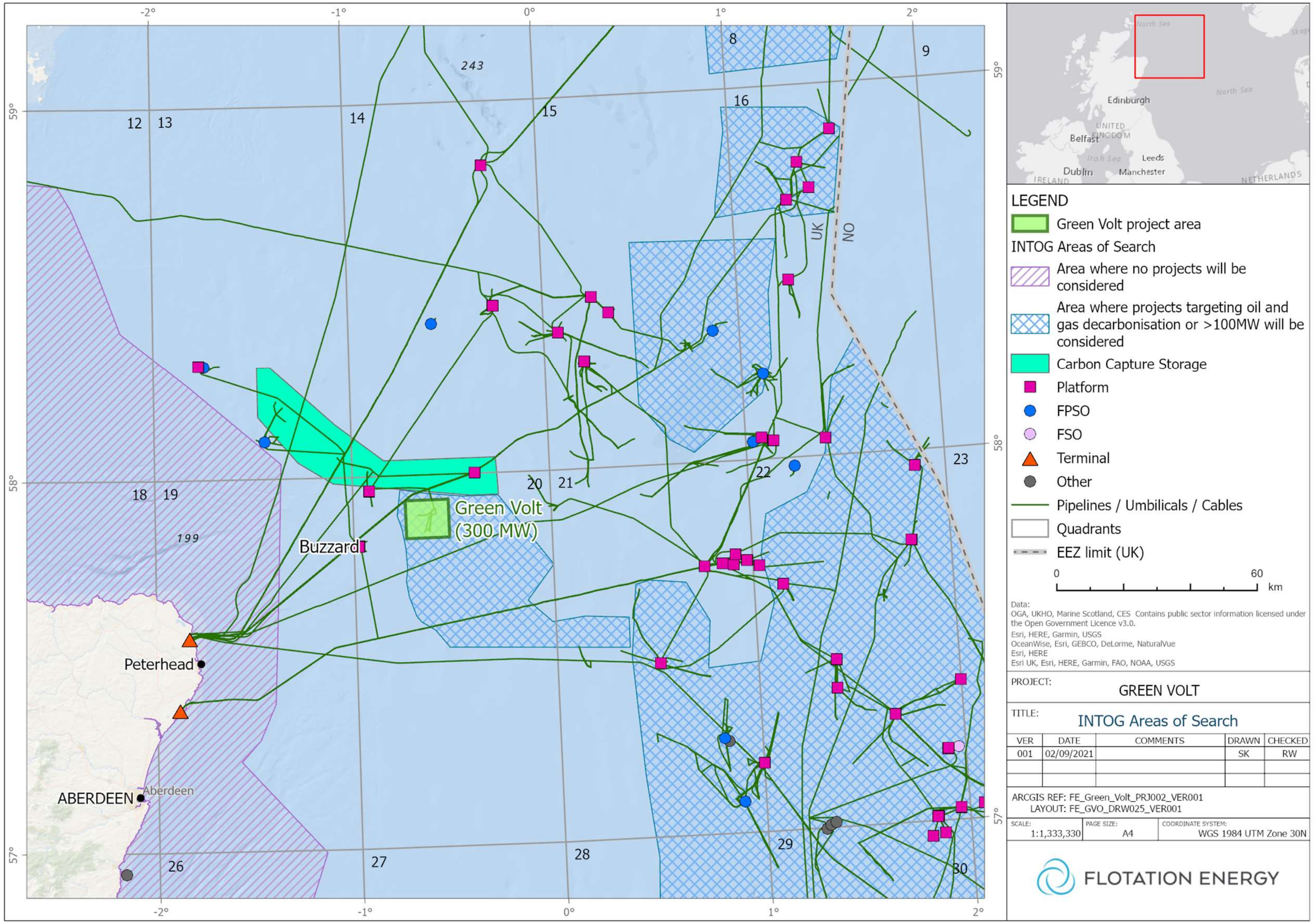


Figure 1.4: Green Volt Offshore Windfarm and INTOG Areas of Search

Green Volt will seek to acquire a site lease in accordance with the INTOG process. At the time of writing in Q4 2021, the Green Volt Project Area falls entirely within the proposed area of search addressed by the INTOG process. Potential INTOG projects will be able to apply for exclusivity agreements at an early stage, although only project locations included within the final INTOG plan will be awarded Option Agreements. Projects that progress through the planning process will still require the appropriate marine licences and section 36 consent under the Marine (Scotland) Act 2010 and the Electricity Act 1989, respectively.

Whilst it is hoped that the Green Volt Project will achieve an award of seabed rights from Crown Estate Scotland through the INTOG leasing process, it has not done so to date and the project, as described in this screening report, is entirely subject to award, or not, of rights by Crown Estate Scotland within that process.

This report has been independently prepared by Flotation Energy PLC for the Green Volt Project and does not reflect the views or intentions of Crown Estate Scotland or any other party. Any references in this report to general terms of seabed rights or timetable in relation thereto are indicative only and do not represent any confirmation of commercial terms as between Crown Estate Scotland and Flotation Energy

1.3 Green Volt Offshore Wind Ltd. (Project Developer)

Flotation Energy Plc (Flotation Energy) is jointly evaluating the potential of the Green Volt Offshore windfarm with CNOOC Petroleum Europe LTD (CPEL), the operator of the Buzzard oil field and its largest shareholder. Flotation Energy will be the lead developer of the project and has formed a dedicated company to drive forward the development of the Green Volt Offshore Windfarm. The new company will be called Green Volt Offshore Wind Ltd (herein referred to as Green Volt).

Flotation Energy is an offshore wind development company, headquartered in Edinburgh, UK. Founded in 2018, the company is pioneering the deployment of both floating and fixed offshore wind in the UK and Internationally. Flotation Energy's UK projects include:

- Green Volt Offshore Windfarm (this development);
- Morecambe Offshore Windfarm (480 MW offshore wind, awarded as part of the England and Wales Round 4 auction); and
- White Cross Floating Windfarm (100 MW offshore wind, South West England).

The company is also active in Europe and Internationally, with a total offshore wind development pipeline of over 10 GW capacity.

CNOOC Petroleum Europe Ltd (CPEL) is the operator of the Buzzard, Golden Eagle and Scott platforms. CPEL is also the largest shareholder in the Buzzard oil field and is seeking to maximize the value of its existing portfolio, while creating new opportunities for global growth. CPEL fully supports the transition to Net Zero and the UK North Sea Transition Deal and recognises the importance of reducing the carbon intensity of UK oil and gas. As a shareholder in Green Volt, CPEL will work with Flotation Energy to deliver the windfarm in the rapid timescale required by the North Sea Transition Deal.

2 Project Description

2.1 Design Envelope Approach

The Project Design Envelope approach (also known as the Rochdale Envelope approach) will be adopted for the Green Volt Offshore windfarm assessment, in accordance with current best practice and the National Policy Statement (NPS EN-3 (paragraph 2.6.42)) which recognises that: *"Owing to the complex nature of offshore wind farm development, many of the details of a proposed scheme may be unknown to the applicant at the time of the application, possibly including:*

- *precise location and configuration of turbines and associated development;*
- *foundation type;*
- *exact turbine tip height;*
- *cable type and cable route; and*
- *exact locations of offshore and/or onshore substations."*

The Green Volt Offshore windfarm design envelope will provide maximum and minimum parameters where appropriate to ensure the worst-case scenario can be quantified and assessed in the EIA. The project description, including the design envelope, will be detailed here as well as in the EIA Report to provide an overview of proposed infrastructure of Green Volt Offshore Windfarm.

2.2 Green Volt Infrastructure

Green Volt Offshore windfarm infrastructure details are summarised within three grouped categories:

- Windfarm Site: details of the design envelope for the wind turbine generators, floating substructures, moorings, inter-array cables, electrical substation.
- Export Cables: providing details of the design envelope for the proposed export cable to Buzzard Oil Field, and the proposed export cable to shore.
- Landfall: location for the onshore/offshore interface for the proposed export to shore cable.

Figure 1.3 provides an overview of the proposed location of the various Project assets.

2.2.1 Offshore Windfarm

It is anticipated that up to 30 floating WTGs will be deployed within the Windfarm Site. This infrastructure will harness average wind speeds of 10.93 m/s with an expected capacity factor of 55%.

2.2.1.1 Wind Turbine Generators

Each WTG will have a rated capacity of between 10-16 MW. The WTG/substructure design will ensure that the minimum blade height (blade clearance) is always at least 22 m above sea level. It is expected that turbine sizes of 12 MW+ will be the market norm and WTG of 16 MW rated capacity are likely to be available. A manufacturer has not been confirmed to date. The project expects to consider proposals from Siemens Gamesa, GE and Vestas (successfully installed at the Kincardine Floating Windfarm; Figure 2.1).

Figure 2.1 Vesta 9.5 MW turbine supported by the Windfloat2 substructure on the Kincardine floating windfarm

Although floating wind is a novel technology, the project expects to be able to deploy commercially available offshore wind turbines without substantial modification. There is, therefore, a high degree of confidence in the overall technical specification of the WTG at this stage in the Project (Table 2.1).

Table 2.1 WTG design envelope

Type/Option	Design Envelope
WTG Capacity	10 MW – 16 MW per turbine
Development Size	Up to 30 turbines
WTG Hub Height (to centreline of hub)	Lowest Astronomical tide (LAT) Sea level +133 m
Operational wind speed	3.5 m/s - 30 m/s
WTG Blade Length (to centreline of hub)	111 m
WTG blade width	4.5 m
Effective Tip Height	Mean sea level + 270 m
Blade Clearance	22 m above mean sea level (MSL)
Colour	Matt light grey/off white
Navigation Lighting	As required by Civil Aviation Authority (CAA), Maritime and Coastguard Agency (MCA), etc

The final layout of the windfarm components shall be determined by environmental, technical and human use factors. The preliminary arrangement is presented in Figure 2.2. Results of surveys and consultation may highlight constraints on the site that will influence the overall site layout. Design considerations for the final layout will be influenced by seabed characteristics; avoiding existing oil infrastructure left on the seabed following decommissioning and benthic communities – none of which have been identified during the 15 years site survey and final site assessments undertaken in 2021. Geotechnical conditions, modelled metocean conditions, and foundation and installation options will also influence final WTG layout.

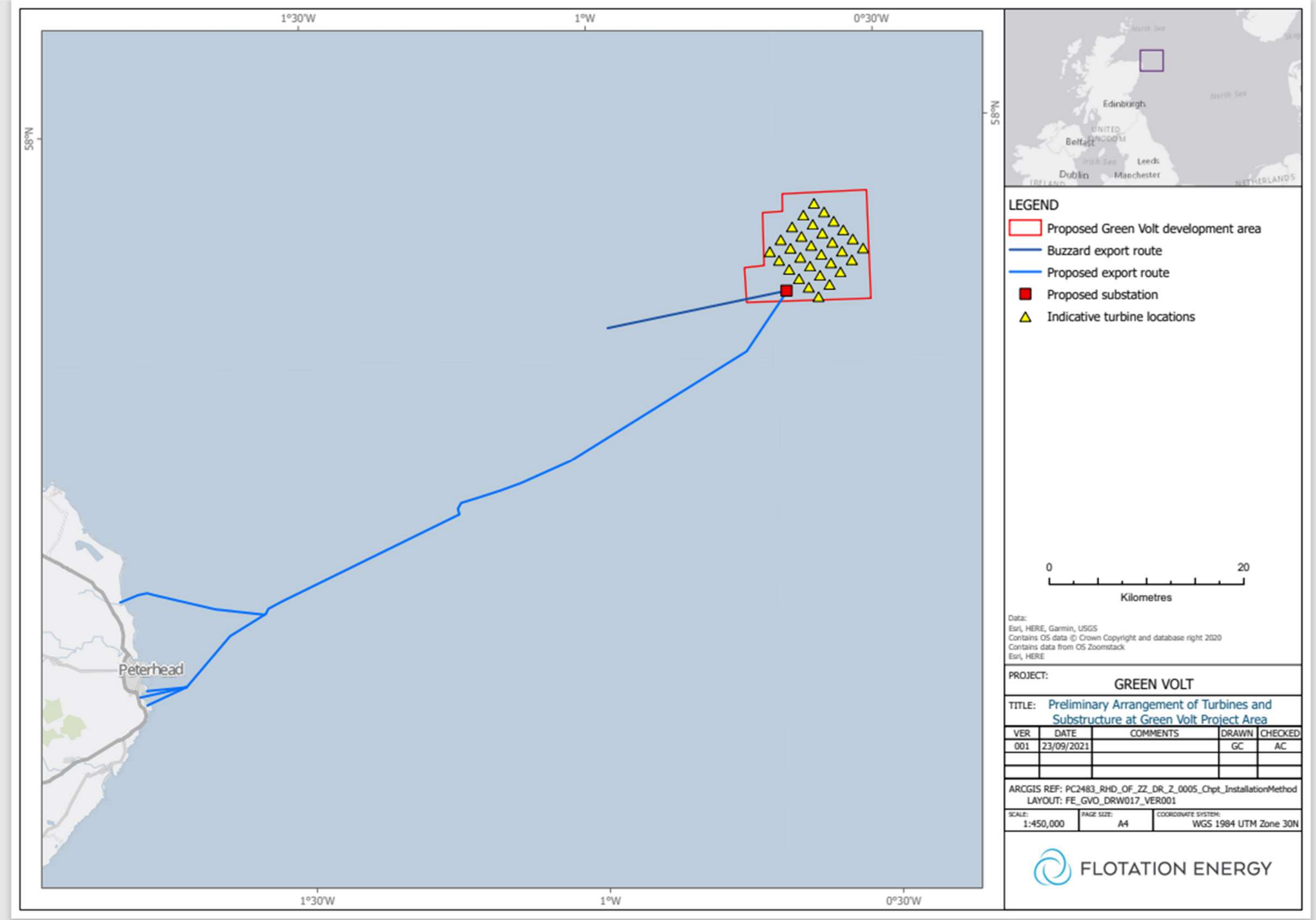


Figure 2.2 Preliminary arrangement of turbines and substructure at Green Volt Project Area.

2.2.1.3 Floating Substructures

A floating substructure will support each of the WTG. Floating substructures are a novel technology, and the Project is currently reviewing a number of designs which could be suitable for the Green Volt Offshore Windfarm. Table 2.2 provides the design envelope for the floating substructures.

It is anticipated that, due to soil conditions at the site, the WTGs will be restricted to a substructure which is moored using a catenary mooring system. This is the same type of mooring system which was previously employed by the Floating Production Storage Offloading (FPSO) vessel installed on the Ettrick and Blackbird oilfield and the Kincardine Floating Wind Farm.

Green Volt will assume a conservative design envelope based on the Kincardine offshore floating windfarm, which used the Windfloat substructure designed by Principle Power Inc.

Table 2.2 Floating Substructure design envelope

Type/Option	Design Envelope
Sub-Structure Type	Semi-submersible
Elevation Above Waterline	12 m
Geometry	Equilateral 3 or 4 sided
Horizontal Face Length	Max 100 m
Diameter of Vertical Columns	14 m
Access Points	Two boat-landings
Electrical Cable Access	Up to three J or I-tubes
Mooring Points	Up to 6-point mooring (expected 3-4)
Colour	Yellow
Navigation Lighting	As required by CAA, MCA, etc

2.2.1.4 Moorings

Floating substructures require moorings to anchors on the seabed to maintain position over the lifetime of the development. The type and number of anchors and moorings required will be subject to refinement upon selection of the substructure and a review of loading conditions. A number of anchor types will be considered (Table 2.3) during the design process, with pin piles being the least likely option to be used. However, they have been included in the design envelope to ensure all potential options and alternatives for anchors are examined. In all cases, it is expected that moorings will be of a catenary design with drag embedment anchors. Expected mooring lines will have ~1000 m of length, weight of 462 kg (studless) per metre, and consist of steel anchor chain.

Amongst competitive floating WTG substructure manufacturers, designs range from utilising three to six mooring lines per substructure. For the purposes of providing a conservative initial mooring design envelope, Green Volt will assume six mooring lines per substructure in the initial design (Table 2.3).

Table 2.3 Mooring system design envelope

Type/Option	Design Envelope
Number of Mooring lines per WTG	Maximum 6 (expected 3-4)
Mooring Type	Catenary
Anchor Type	Drag embedment anchors, torpedo anchors, gravity-based anchors, suction piles, pin piles (highly unlikely)
Maximum seabed displacement	10 x 10 m per anchor 18,000 m^2 total array
Mooring Lines	Anchor chain, mooring cables, polyester mooring lines
Pennant Wires/Buoys	Temporary surface buoys during construction
Pennant Wires/Buoys	Permanent submersible buoys at seabed for remotely operated vehicle (ROV) recovery
Mooring Line Radius	Max approx. 7.5 x water depth (circa 750-800 m)

A typical elevation sketch of a single mooring line with a corresponding drag embedment anchor is shown in Figure 2.3.

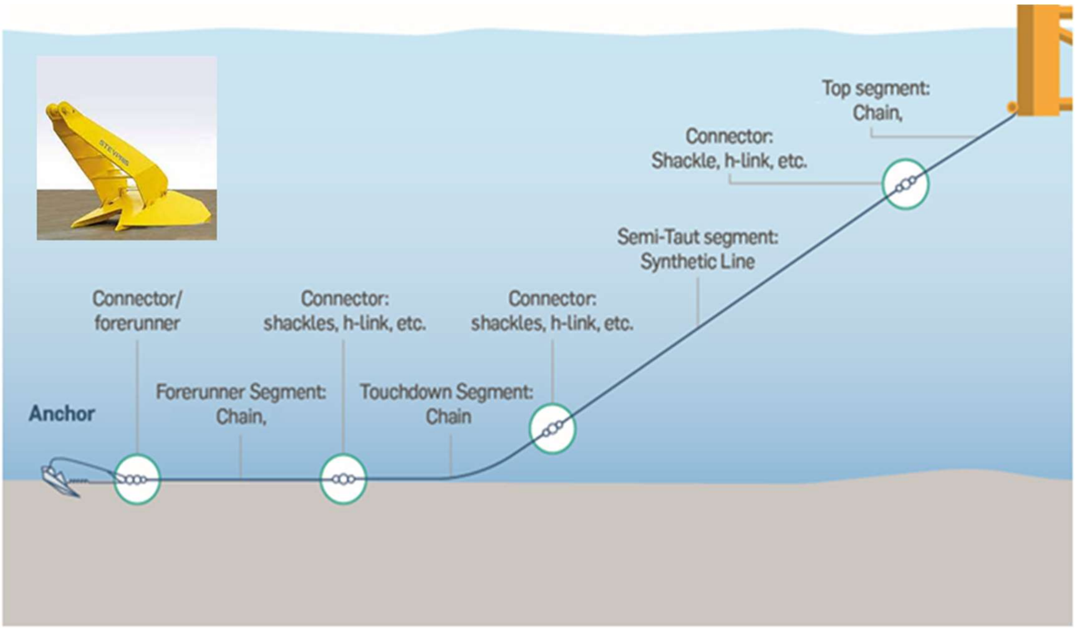


Figure 2.3 Elevation sketch of typical catenary mooring system, with a picture in the top left of a drag embedment anchor (18Te Stevpris Mk 6)

Marine structures such as fixed turbine foundations, and cables, can be susceptible to erosion, or scouring of the bed sediment in the vicinity of their foundations due to the action of waves, currents and tides. Floating sub-structures, reliant upon a catenary mooring system, reduce interaction with the seabed significantly and pose a much-reduced potential for scour. There is a low risk of sediment scour around the anchors for the floating turbines at the Windfarm Site. This has been confirmed by reviewing the 2021 geophysical decommissioning survey data of the Ettrick and Blackbird oil and gas installations, and the placement of previous anchor systems on the seabed in this zone, including the nine-year installation of the FPSO anchor system (16 separate anchors) over eight years as part as part of the post decommissioning monitoring work undertaken at the Ettrick and Blackbird oil field. Therefore, scour protection will not be required at the Windfarm Site.

2.2.1.5 Inter-Array Cables

Green Volt Offshore Windfarm will consist of up to 30 floating WTGs, each arranged within electrical strings of 5-6 units. Power generated by the WTGs will be collected via a series of inter-array cables. The arrangement of the cables, connecting the turbines into an array, is determined by the layout of the windfarm, which is usually optimised for production of power given the prevailing wind direction on site. A priority of the inter-array cabling is to provide redundancy, in the case of cable failure or breakdown, whilst seeking to ensure cable integrity. Further studies will be required to optimise the cable array once the turbine and foundation type have been confirmed.

Inter-array cabling is usually surface laid and, where required, post lay buried for protection. As the Green Volt Offshore Windfarm will use floating sub-structures to support the turbines, a focus of the early-stage engineering will be to ensure that all inter-array and export cable approaches to the structures are properly addressed to ensure the longevity of the assets. The assessment of possible post lay burial/protection will be undertaken following a review of the site lay out and mooring design for the floating structures, including a review of navigational safety at site with the mooring system design selected. It is currently proposed that the inter-array cables are not buried due to the lack of commercial fishing activity within the development area and the placement of the mooring spreads for each structure. However, trenching of the inter-array cables will be considered as part of the initial engineering assessments.

Table 2.4 provides a summary of the expected design envelope for the inter-array cables.

Table 2.4 Inter-array cables design envelope

Parameter	Design Envelope
Number	Up to 35
Length	2.5 km each total 87.5 km
Cable Outer Diameter	250 mm
Total Area of Seabed Coverage	70,000 m^2
Rated Capacity	66 kV
Installation	Laid on seabed or trenched to agreed depth of lowering (DoL) – approx. 0.6 m - 1.5 m (if required)
Burial	Extent of burial to be confirmed.
Scour Protection	None anticipated, scour protection during installation if deemed necessary post further surveys prior to installation. Max 10% of total length rock protection is anticipated - 7 km (7,000 m^2)

2.2.1.6 Offshore Substation Platforms

Up to two offshore substation platforms (OSPs) will be required for the Green Volt Offshore Windfarm. These will likely be supported on a jacket structure which will provide the marshalling point for the WTG inter-array cables and the required voltage conversion transformers to enable export of electricity to the Buzzard facility and to the offshore export cable (connecting to Onshore Transmission Infrastructure (OnTI)).The OSP will also provide relevant metering of power to/from Buzzard and to/from the onshore grid connection point. Offtake capacity for the Buzzard facility will be via an offshore export cable (noted in Figure 2.2). Additional clarity will be provided during initial project engineering, and this will be updated within the consenting process as more information is available. The offshore substation is likely to be similar in scale and size as the standard offshore transmission substation, such as the Beatrice Offshore Windfarm substations. Table 2.5 presents the design envelope under consideration for the OSP Table 2.5.

If a fixed substation structure is chosen, this will require small scale pin piles (circa 1.5 - 2 m diameter) to secure the jacket to the seafloor, as for a standard oil and gas platform. The potential impact of the piling activity and resulting piles will be assessed as technical definition matures, but it may be noted any piling activities will be minimal in scope. If a floating offshore substation is opted for, an anchoring infrastructure would be required similar to that of the floating WTG substructures. This option would not involve any piling. The selection of any substructure for the substation is likely to be based on the technology readiness levels of both floating offshore substations and the availability of dynamic export cables within the project development timeline.

Table 2.5 Offshore Substation Design Envelope

Type/option	Design Envelope
Dimensions	26 x 26 x 15 m
Structure Type	Jacket
Weight	3,000 Tonnes
Minimum Height Above Water	22 m
Pin Piles	3 or 4 per leg

2.2.2 Export Cables

The Green Volt Offshore windfarm will connect directly to the Buzzard platform via an electrical cable from the (newly built) offshore substation. The cable is expected to be ~15 km in length. The operating voltage of the electrical connection to Buzzard is subject to design review but is expected to be between 11 - 33 kV. Final selection will be based on an economic analysis, with the additional objectives of minimising brownfield modifications to Buzzard and enabling simple energization of the platform.

An offshore export cable will carry the power ~90 km to the landfall location along the Aberdeenshire shore. An onshore export cable of ~30 km will connect to the offshore export cable and will transmit power back to the onshore Green Volt substation, where it will join the OnTI to the UK grid.

The Project will have a maximum of two, dual redundant export cables to landfall. It is expected that both export cables will run in close proximity and within the same cable corridor. Two potential landfalls are under consideration and landfall is anticipated to be installed through horizontal directional drilling (HDD). Table 2.6 provides a summary of the expected design envelope for export cables.

Table 2.6 Export to shore cable design envelope

Parameter	Design Envelope
Number	2
Length	Up to 120 km
Length Offshore	75 km
Cable Outer Diameter	<500 mm
Installation Method Offshore	Trenching, laying and burial
Trench Width Per Cable	3 m
Trench Depth	1.5 m
Separation Distance Between Cables	Up to 250 m
Cable Corridor Width	1,000 m
Rated Capacity	220 to 275 kV
Burial at Landfall	HDD or trenching (where HDD is not possible)

Burial Offshore if DoL not achieved	Rock dumping in trench to bury cable if the sediment removed from trench does not provide sufficient material to bury cable. Max anticipated 25% of cable length 90 km each cable 15 km total
Scour Protection	None considered – to be monitored during operational phase

Export cables are often a point of vulnerability for offshore wind as failure in the transmission asset can render the entire farm inoperative. Damage, once in operation, usually arises from external aggression originating from fishing operations or vessel anchoring. To overcome this, and to provide security during installation, cables are usually separated by a distance that is a function of water depth. In the water depths envisaged along the export route from the windfarm area to shore, we would expect this separation to be a minimum of 250 m, with export cables converging locally at the onshore landing point. Green Volt will aim to route cables through areas where there is sufficient sediment to allow for burial, whilst avoiding side slopes and variable seabed conditions.

Cable burial/armouring requirements will be assessed following the completion of side scan and sub bottom profiling surveys. Should any sections of the marine cable require additional protection following combined lay/burial operation, then this will be provided by post lay jet burial, engineered, localised rock dumping or mattressing. Sections of cable may also be fitted with additional cast iron or synthetic external cladding to provide localised protection in certain areas. It is expected that this additional protection will be needed for the inshore portion of the export cables (within approximately 15 km of shore). Such protection would replicate the practice for all of the pipeline installations in the local area, the export cable for Hywind Scotland and also the planned NorthConnect cable, which is located next to the Green Volt export cable for a significant amount of the offshore export cable length.

2.2.3 Landfall

The landfall location for the export cable has not yet been determined; however, two principal areas are currently under consideration:

- North of Peterhead (Figure 1.3) with various possible locations for an onshore / offshore jointing pit and onward cable to New Deer. Locations to the north allow the project to avoid the Buchan Ness to Collieston Special Protection Area (SPA) and Special Area of Conservation (SAC) but provide a more complex path onshore with a number of river crossings on route to the project substation at New Deer.
- South of Peterhead (Figure 1.3) with various possible locations for an onshore / offshore jointing pit and onward cable to New Deer. Locations to the south may require crossing the Buchan Ness to Collieston SPA and SAC but may provide a clearer path to the project substation at New Deer.

It is expected that for either location, HDD will be used to take the cable from the jointing pit to a location 200-300 m offshore. Open trenching will only be used in the event that HDD cannot be used due to technical or engineering constraints; no open trenching is proposed within the Buchan Ness to Collieston SAC or SPA to avoid direct impacts on the vegetated sea cliff features.

A jointing pit will be used to provide the connection point between the offshore export cable and onshore export cable. Phase compensation reactor(s) will be permanently installed above the jointing pit. The final size of the site will be approximately 10 m by 10 m. Jointing pits and onshore infrastructure will not be located within the Buchan Ness to Collieston SAC or SPA.

2.3 Green Volt Project Timeline

The overarching aim of Green Volt is to decarbonise the production of offshore oil and gas fields from the earliest possible time point. A high-level project schedule is shown in Figure 2.4.

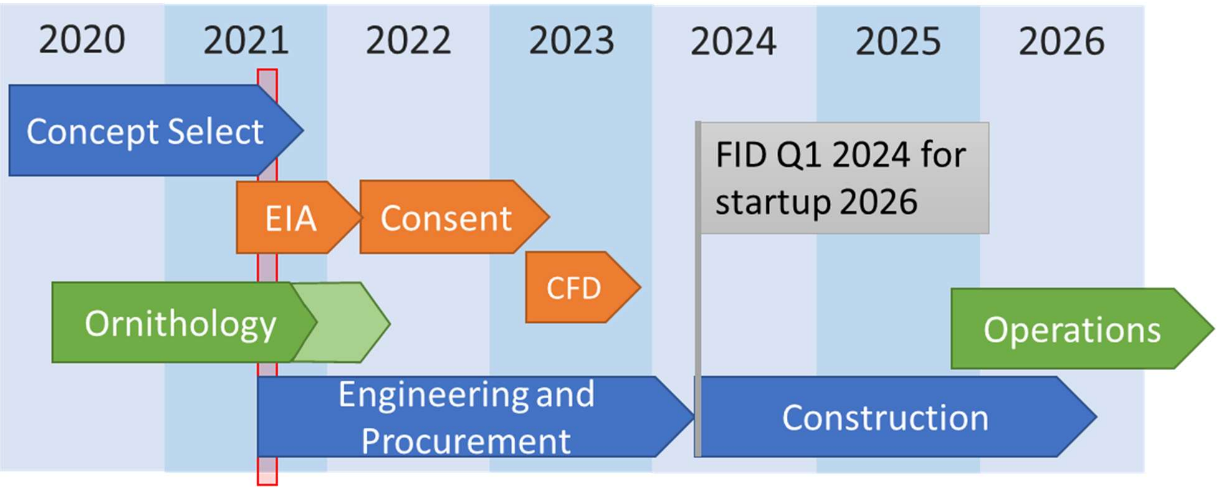


Figure 2.4: Green Volt Offshore Windfarm proposed timeline

The Green Volt Offshore windfarm project timeline has been designed around this overarching aim and considered and addressed a number of constraints, which are summarised below:

1. The primary business case for execution of Green Volt Offshore windfarm rests upon its ability to remove CO_2 emissions produced by power generation from offshore oil and gas facilities, and to eliminate these emissions from the earliest possible time point, accelerating the UK's journey towards Net Zero emissions and the goals of the North Sea Transition Deal.
2. Oil and gas facilities have a limited lifetime and any delay to project completion impacts both the ability to mitigate emissions and the business case for completion ahead of eventual oil and gas decommissioning.
3. Floating wind is a novel technology with huge potential for the UK. HM Government has announced a target for 1 GW offshore floating wind installation by 2030 and the Green Volt Offshore windfarm provides a substantial contribution towards this target, building UK experience and driving down the cost of future offshore floating wind.
4. In order to meet the criteria for the Contract for Difference (CFD) scheme in 2023, Green Volt requires prior Consent for construction to be obtained from Marine Scotland.
5. To have the required documentation (e.g., EIA Report, PAC report, etc) presented for submission in March 2022.

2.4 Construction

Initial onshore fabrication and offshore construction will start on 1 April 2024, following the project Final Investment Decision (FID) process. Construction (offshore – onshore work will start in mid-2024) is scheduled over two seasons, with the aim of connecting the Buzzard oil field to the UK grid by Q2 2025 and completing and energizing Green Volt Offshore windfarm by 2026. Construction is expected to start in the first half of 2025 with the installation of the substation, offshore export cable and final connection to Buzzard oil field.

One of the main advantages of floating offshore wind substructures is that a considerable amount of the offshore site construction activity can take place onshore in port construction zones before the fully assemble units are towed out to site for mooring and electrical cable connection. This not only substantially reduces the extent of marine operations associated with the project construction; therefore, significantly reducing underwater marine noise against a fixed offshore windfarm installation, but also the requirement for very large specialist construction vessels during installation operations (such as Neart na Gaoithe, using the Saipem 7000, one of the world's largest offshore crane vessels, to install its fixed substructures). The duration of floating offshore wind turbine construction activities is significantly shorter than that of traditional fixed foundation wind turbines. The WTGs are expected to be installed in 2026 with the assumption that one substructure and corresponding floating turbine can be assembled and towed out to site each week.

The typical construction phases would include:

- the construction site is mobilised, local manufacturer commences, and windfarm components are delivered;
- civil engineering works are undertaken for the onshore substation connection to the export cable
- substructure moorings are installed and pre-tensioned;
- the WTG is towed to site and moored on position;
- following connection at the agreed landfall point, the sub-sea electricity cables are laid between the shore and site;
- subsequent turbines are installed;
- the inter-array cables within the windfarm are installed; and
- the systems are tested and commissioned, and the construction plant is demobilised.

Pre-installation of the moorings will be conducted prior to arrival of the substructures and WTGs at the Windfarm Site. This work can be conducted by a suitably equipped anchor-handling vessel. By eliminating the use of piled anchors for attachment of the mooring lines to the seabed, we anticipate that the final configuration will include drag embedment anchors, with associated chain, clump weights and wire rope in the arrangement. Following deployment of the pre-installed/tensioned the mooring system, cable ends would be buoyed off temporarily, for later recovery and attachment to the WTG/sub-structure assembly following its arrival on site.

Following installation and partial commissioning of the WTG on the completed sub-structure alongside the fabrication facility, or inshore, each completed unit would be towed out to site by anchor handling tugs.

Installation of the OSP foundations (piling) will implement all required noise mitigation, as identified from the impact assessment (primarily marine mammal impact assessment). This may include using a soft start method for piling with no simultaneous piling, use of a marine mammal observer and/or passive acoustic monitoring (PAM), and use of an acoustic deterrent device (ADD), amongst others. The piling procedure will use mud mats positioned on the seabed for piles to be inserted through stab guides. Each pile will take approximately 8-10 hours to install followed by a wait period of 24 hours to allow grout to set before testing.

The preferred method of cable installation would involve the simultaneous lay and burial of the cable from a dedicated cable installation vessel; this will be reviewed following the completion of the engineering work and export cable survey.

Throughout the construction phase and, subject to discussions with the Maritime & Coastguard Agency (MCA) and other stakeholders, navigational marker buoys may be required to identify the location of the site boundaries or to provide warnings regarding the existence of temporary facilities under the seabed. These temporary measures may be replaced by permanent markings in accordance with agreed requirements, for the lifetime of the project.

Cable pull-in at landfall will, most likely, be achieved via a directionally drilled conduit. At the landfall, if cable routing is via HDD, care will be taken to engineer the arrangement so it conforms to consenting or engineering requirements. Drill mud discharge will be kept to a minimum and will be water-based, rather than oil-based, with minimum drilling lubricants used during the final exit phase onto the seabed.

Green Volt will formulate an environmental policy specific to the project which will set out environmental targets for the construction phase of the project. The policy will be included in tender documents as a requirement on contractors who should be able to demonstrate a track record and proven ability to meet the environmental standards. An environmental management plan, amongst others, will be developed to provide a framework to protect the environment before, during and after installation to ensure that all legislative and regulatory requirements are met. This will include details of environmental monitoring, auditing and reporting systems to be employed during installation.

2.5 Operation and Maintenance

During the operational period, scheduled and unscheduled monitoring and maintenance of offshore infrastructure will be required. During the project life, it is likely that some refurbishment or replacement of offshore infrastructure will be required. All offshore infrastructure, including WTGs, floating substructures, cables and offshore platforms will be included in monitoring and maintenance programmes.

It is likely that Green Volt Offshore windfarm will be managed, operated and maintained from an onshore facility. Onshore activities would include the following:

- control room for remote operation of Green Volt Offshore Windfarm;
- port facilities where vessels, maintenance equipment, spares and consumables are stored;
- onshore operations base for management of work and personnel; and
- helicopter hangar and base (if required).

Operation and maintenance (O&M) activities may be required at any time, 24 hours per day, 365 days per year. The majority of control activities will be undertaken remotely from shore using a control centre; however, offshore access and intervention will be required to maintain and potentially repair or refit plant and equipment. Maintenance can be generally separated into three categories:

- Planned maintenance: this includes general inspection and testing, investigation of faults and minor fault rectification, as well as replacement of consumables. It is anticipated that these events will be undertaken during summer months as the weather is likely to be more favourable, offering an increased maintenance window. Scheduled maintenance and inspection is likely to occur every six to twelve months. Inspections of subsea cables will be performed on a periodic basis.
- Unplanned maintenance: this applies to defects occurring that require rectification out-with the planned maintenance periods. The scope of such maintenance would range from small defects on non-critical systems to failure or breakdown of main components potentially requiring them to be repaired or replaced.
- Periodic overhauls: these will be carried out in accordance with equipment manufacturer's warranty and specifications. These are likely to be planned for execution in periods of the year with the best access conditions.

The Crown Estate Scotland lease for Green Volt Offshore windfarm will likely be for 50 years, with the design life of the turbines and other components of the windfarm being of a similar period of time when repowering is considered.

During the operational phase of the proposed Project, the offshore array will be marked with appropriate navigational marker buoys to provide the necessary warning to mariners of the presence of the site. The exact type and configuration of any navigational markers will be determined via consultation with the MCA and Northern Lighthouse Board (NLB) and will also be informed by the outputs of the project-specific Navigation Risk Assessment (NRA). Consideration will be given to use of virtual aids to navigation as well as buoyage. The site will be marked on the UK hydrographic charts and through Kingfisher Information Service - Offshore Renewable & Cable Awareness (KIS-ORCA) to manage fisheries awareness. The actual WTG will also be marked in accordance with relevant aviation requirements and via consultation with key organisations (MCA, Civil Aviation Authority (CAA)). CAA Policy and Guidelines on Wind Turbines CAP 764 (CAA, 2016) will be followed.

National Air Traffic Services (NATS) will be consulted regarding the impact upon civil aviation radar operations by the proposed scheme. This will include the identification of potentially sensitive receptors to the floating offshore windfarm, including all known military and civil aviation facilities.

The proposed site is marked on Figure 7.20, which shows the aviation activity in the northeast of Scotland. The development area is located outside of any primary approach radar system and located inside the nominal helicopter lines (these are not fixed routes, but angle vectors indicating outgoing and incoming flight sectors for helicopters) noted on the map. It should be noted there a no helicopter platforms within 6 nm of the development, with the nearest helideck being located on the Buzzard platform due west of the Green Volt Offshore Windfarm.

2.6 Decommissioning

Decommissioning requirements are set out in the Energy Act 2004 (as amended) and latest Offshore renewable energy: decommissioning guidance (Scottish Government, 2019b). These will influence all design of the Green Volt Offshore windfarm. This will be a key requirement under the Crown Estate Scotland lease agreement.

A Decommissioning Programme will be prepared prior to construction, in line with the requirements of the Energy Act 2004 (as amended). However, for the purpose of this Screening Report, the following has been assumed: floating substructures components would be removed, where practicable, with mooring lines, and piles to be cut just below seabed and removed. The approach to decommissioning, including cable decommissioning, will be reviewed as part of the Decommissioning Programme. It is expected that decommissioning will require similar vessels to those used in construction and take a similar period of time.

The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator.

2.7 Summary of Green Volt Project

Table 2.7 summarises the key elements of the Green Volt Offshore windfarm, as it is currently planned.

Table 2.7 Design envelope summary for the Green Volt Offshore windfarm

Project Component	Parameter	Current assumed values
Site	Project Area	144 km^2
	Water depth	100 - 115 m
	Distance to shore from closet WTG	75 km
	Mean Wind Speed	8.7 – 9.5 m/s
Turbine	WTG Capacity	10 MW – 16 MW per turbine
	Development Size	Up to 30 turbines
	WTG Hub Height (to centreline of hub)	LAT Sea level +133 m
	Operational wind speed	3.5 m/s - 30 m/s
	WTG Blade Length (to centreline of hub)	121 m
	WTG blade width	4.5 m
	Effective Tip Height	Mean Sea level + 270 m
	Blade Clearance	22 m MSL
	Colour	Matt light grey/off white
	Navigation Lighting	As required by CAA, MCA, etc
Substructure	Sub-Structure Type	Semi-submersible
	Elevation Above Waterline	12 m
	Geometry	Equilateral 3 or 4 sided
	Horizontal Face Length	Max 100 m
	Diameter of Vertical Columns	14 m
	Access Points	Two boat-landings
	Electrical Cable Access	Up to three J or I-tubes
	Mooring Points	Up to 6-point mooring (expected 3-4)
	Colour	Yellow
	Navigation Lighting	As required by CAA, MCA, etc
Moorings	Number of anchors	Up to 6 point mooring (expected 3-4)
	Anchor Type	Drag embedment anchors, torpedo anchors, gravity-based anchors, suction piles, pin piles (highly unlikely)
	Maximum seabed displacement	10 x 10 m per anchor 18,000 m^2 total array
	Potential dimensions on seabed	Up to 10m2
	Height above seabed	Up to 2 m, but full burial in seabed planned
	Mooring type	Catenary
	Number of mooring lines	Up to 6 per WTG 180 total array
	Mooring line radius	Up to 7.5 x water depth and touchdown within 250 m
	Buoys	Temporary surface buoys during construction and Permanent submersible buoys at seabed for ROV recovery. 1 per mooring lines, 180 total array
Inter-array Cables	Number	Up to 35
	Length	2.5 km each total 87.5 km
	Cable outer diameter	250 mm
	Total area of seabed coverage	Up to 70,000 m^2
	Rated capacity	66 kV
	Installation	Laid on seabed or trenched to agreed depth of lowering (DoL) – approx. 0.6 m - 1.5 m (if required)
	Burial	Extent of burial to be confirmed.

	Scour protection	None anticipated, scour protection during installation if deemed necessary post further surveys prior to installation. Max 10% of total length rock protection is anticipated - 7 km (7,000 m2)
Offshore Substation Platform	Dimensions	26 x 26 x 15 m
	Structure Type	Jacket
	Weight	3,000 Tonnes
	Minimum Height Above Water	22 m
	Pin Piles	3 or 4 per leg
Export Cable	Number	2
	Length	Up to 120 km
	Length offshore	75 km
	Cable outer diameter	<500 mm
	Installation method offshore	Trenching, laying and burial
	Trench width per cable	3 m
	Trench depth	1.5 m
	Separation distance between cables	Up to 250 m
	Cable Corridor Width	1,000 m
	Rated capacity	220-275 kv
	Burial at landfall	HDD or trenching (where HDD is not possible)
	Burial offshore if 1.5m depth not achieved	Rock dumping in trench to bury cable if the sediment removed from trench does not provide sufficient material to bury cable. Max anticipated 25% of cable length 90 km each cable 15 km total
	Scour protection	None considered – to be monitored during operational phase

3 Policy and Legislative Context

The following section sets out the key policy and legislation of relevance to the Green Volt Offshore Windfarm.

3.1 Need for The Development

3.1.1 Kyoto Protocol to the United Nations Framework Convention on Climate Change

The UK is a signatory to the Kyoto Protocol which commits state parties to reduce greenhouse gas emissions, which came into effect in 2005. Its commitments were transposed into UK law by the Climate Change Act 2008, which requires the net UK carbon account for the year 2050 to be 80% lower than the 1990 baseline.

3.1.2 North Sea Transition Deal

As part of the UK's commitment to Net Zero, the oil and gas industry has committed to the UK Oil and Gas North Sea Transition Deal (OGUK, 2021), which calls for significant reductions in the emissions caused by oil and gas production. For Scope 1 emissions, which relate to those from the process of oil and gas extraction, the UK oil and gas industry has committed to reductions of:

- 10% CO_2 reduction by 2025
- 25% CO_2 reduction by 2027
- 50% CO_2 reduction by 2030

As of 2021, approximately 70% of offshore emissions associated with oil and gas production in the North Sea are caused by offshore power generation (Rystad Energy, 2020). See Section 1.2.3 for further details.

3.2 European Parliament and Council Directives

3.2.1 Brexit

On 31 January 2020, after triggering article 50 of the Lisbon Treaty, the UK formally left the European Union (EU) (Brexit). Since formally leaving the EU, the UK Government has committed to implement international environmental obligations in accordance with the EU (Withdrawal) Act 2018 and to maintain environmental commitments and legislation already made. On this basis, the existing EU renewable energy targets for the UK, including the EU Renewable Energy Directive 2009/28/EC will remain applicable.

3.2.2 European Union Renewable Energy Directive

To keep the EU a global leader in renewables and as part of the Clean energy for all Europeans package, the Revised Renewable Energy Directive (2018/2001/EU) entered into force in 2018. This, in turn, helps the EU to meet its emissions reduction commitments under the Paris Agreement. The revised Renewable Energy Directive set the following targets:

- a minimum of 32% share of renewable energy consumption within the EU; and
- member States to commit to the renewable energy consumption target as part of integrated national energy and climate plans, pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council.

3.3 Scottish Policy and Legislation

3.3.1 National Planning Framework 3

The National Planning Framework 3 (NPF3) (Scottish Government, 2014a) was developed in 2014 and presents plans for development and investment in infrastructure by the Scottish Government over the next 25 years. The NPF3 is supported by the Scottish Planning Policy (SPP) (Scottish Government, 2014b). This includes a series of topics, including renewable energy policies, and acknowledges Scotland's offshore renewable energy resources. With regard to the offshore wind and renewable energy sector, NPF3 presents a key vision in Scotland for the enhancement of the low carbon economy and to be a world leader in low carbon energy generation, both onshore and offshore.

3.3.2 Scotland's Emission Reduction Targets

Scotland has its own targets to reduce greenhouse gas emissions, which are set out in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. This Act aims to ensure Scotland contributes appropriately to the world's efforts to deliver on the Paris Agreement, reached at the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change. The Emissions Reduction Targets includes a reduction of all greenhouse gases to net-zero by 2045 at the latest, with interim targets for reductions of at least 56% by 2020, 75% by 2030 and 90% by 2040.

3.3.3 The Scottish Energy Strategy: The Future of Energy in Scotland

This Strategy sets out the Scottish Government 2050 vision for energy in Scotland. There are six visions for 2050, one of which includes renewable and low carbon solutions, specifically championing and exploring Scotland's huge renewable energy resources and ability to support energy targets.

3.3.4 Sectoral Marine Plan for Offshore Wind Energy

Scotland is committed to ensuring secure, reliable and affordable energy supplies, within the context of long-term decarbonised energy generation. The first Sectoral Marine Plan for Offshore Wind Energy (Blue Seas Green Energy) was adopted in 2011 (Marine Scotland, 2011) which was followed by the draft wind, wave and tidal plans in 2013 (Marine Scotland, 2013). Since then, the Sectoral Marine Plan for Offshore Wind Energy (hereafter referred to as the Plan) (Scottish Government, 2020a) has built on the work undertaken in the development of the 2011 and 2013 plans and incorporates recent technological, policy, regulatory and market developments to develop a new strategic planning process. The Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020a) seeks to contribute to the achievement of Scottish and UK energy targets through the provision of a spatial strategy to inform the seabed leasing process for commercial offshore wind energy in Scottish waters.

The Plan identifies 15 plan options across four regions which are capable of generating several gigawatts of renewable energy. There is the potential for up to 10 GW to be deployed to reflect the anticipated future demand and market appetite, exceeding the Scottish Offshore Wind Energy Council's (SOWEC) goal to deliver at least 8 GW of offshore wind in Scottish waters by 2030. The final Sectoral Marine Plan for Offshore Wind Energy will guide relevant consenting bodies with decision making on licence and consent applications but will not predetermine decision-making processes.

The Plan has been developed in accordance with the strategic aims of the National Marine Plan (Marine Scotland, 2015a), which addresses the potential for interactions between renewable energy development and other marine users.

3.3.5 Offshore Wind Policy Statement

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 sets out commitments for Scotland to reach Net Zero by 2045 The Offshore Wind Energy Policy Statement (Scottish Government, 2020b) sets out ambitions to capitalise offshore wind development and the role this technology could play in meeting this target. The Offshore Wind Energy Policy Statement builds upon the ambitions outlined in Scotland's Energy Strategy (Scottish Government, 2017), which sets out the 2050 energy vision. Scotland's Energy Strategy is integral to the implementation of the Offshore Wind Policy Statement, through the identification of suitable offshore windfarm development areas.

3.3.6 Innovation and Targeted Oil and Gas (INTOG)

In August 2021, Crown Estate Scotland announced the Innovation and Targeted Oil and Gas (INTOG) leasing round, which will take place in early 2022. INTOG has been designed to allow developers to apply for the rights to build offshore windfarms specifically for the purpose of providing low carbon electricity to power oil and gas installations and help decarbonise the sector. INTOG expects to support the delivery of smaller (<100 MW) innovation projects and specifically targets larger (>100 MW) projects that seek to support the decarbonisation of the oil and gas sector, such as the Green Volt Offshore Windfarm.

Green Volt will seek to acquire a site lease in accordance with the INTOG process. At the time of writing in Q4 2021, the Green Volt Project Area falls entirely within the proposed area of search addressed by the INTOG process. Potential INTOG projects will be able to apply for exclusivity agreements at an early stage, although only project locations included within the final INTOG plan will be awarded Option Agreements. Projects that progress through the planning process will still require the appropriate marine licences and section 36 consent under the Marine (Scotland) Act 2010 and the Electricity Act 1989, respectively.

3.4 Planning Legislation

As the Green Volt Offshore windfarm is a generating station with a capacity of greater than 1 MW, it requires the following consents, licences and permissions:

- a Section 36 consent under the Electricity Act 1989;
- a marine licence under the Marine and Coastal Access Act 2009;
- a marine licence under the Marine (Scotland) Act 2010 for the part of the export cable which is within 12 nm of the coast; and
- planning permission under the Town and Country Planning (Scotland) Act 1997 for all Project infrastructure located landward of Mean Low Water Spring (MLWS).

In this offshore Scoping Report, the Section 36 and Marine Licence permissions only are described below. The Town and Country Planning permission is for onshore development only and not discussed here. Should any additional pre-construction licences be required, these will be discussed and agreed with the relevant consenting authority during the pre-construction phase of the Green Volt Offshore windfarm.

3.4.1 Section 36 Consent

As Green Volt Offshore windfarm is an offshore generating station which is greater than 50 MW and located in Scottish Offshore Waters (between 12 nm and up to 200 nm offshore) within the Scottish Renewable Energy Zone (REZ), there is a requirement for consent under Section 36 of the Electricity Act 1989. Section 36 consent will allow for the installation, operation and maintenance of wind turbines and inter-array cables associated with Green Volt Offshore Windfarm.

3.4.2 Marine Licence

Within the UK offshore waters (between 12 nm and up to 200 nm offshore), the Marine and Coastal Access Act 2009 applies. Under the Marine and Coastal Access Act 2009 (as amended) there is the requirement for a marine licence to be obtained prior to the construction, alteration or improvement of any works or deposit any object in or over the sea, or on or under the seabed.

Similarly, under the Marine (Scotland) Act 2010 which applies to Scottish Territorial Waters (between 0 and 12 nm from MHWS) there is also the requirement for a marine licence prior to the construction, alteration or improvement of any works or deposit any object in or over the sea, or on or under the seabed. This applies to the Green Volt Offshore windfarm export cable works.

Where applications for both a marine licence under the Marine and Coastal Access Act 2009 and consent under Section 36 of the Electricity Act 1989 are made and where the Scottish Ministers are the determining authority, they may issue a note to the applicant stating that both applications will be subject to the same administrative procedure. Where that is the case then that will ensure that the two related applications may be considered at the same time.

3.5 Environmental Impact Assessment Regulations

3.5.1 Overview

In compliance with the EU Directive on the assessment of the effects of certain public and private projects on the environment (EIA Directive) (2011/92/EU, as amended by Directive 2014/52/EU), when applying for Section 36 consent, a marine licence or planning permission, an EIA Report is required to be prepared and submitted to support these applications if they are likely to have a significant effect on the environment due to factors such as their size nature or location. An EIA is specifically required (Schedule 2) for installations for the harnessing of wind power for energy production (windfarms) if:

- the development involves the installation of more than two wind turbines; or
- the hub height of any wind turbine or height of any other structure exceeds 15 m.

The Green Volt Offshore windfarm will consist of more than two wind turbines, with a hub height over 15 m; therefore, an EIA is required to be undertaken.

The offshore EIA must fulfil the requirements of the following regulations:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 as amended by The Environmental Impact Assessment (Miscellaneous Amendments) (Scotland). (applies to all applications for s.36 consent in Scottish waters out to 200 nm).
- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (Scotland) (applies to applications that require an EIA for a marine licence from 0-12 nm).
- The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (applies to applications that require an EIA, for a marine licence from 12-200 nm).

3.6 Pre-Application Consultation

Where activity is planned within the Scottish Territorial Waters (i.e., from 0-12 nm), the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013 (hereafter referred to as the PAC Regulations) apply. There is no provision for PAC in the Marine and Coastal Access Act 2009, so these requirements do not apply in respect of relevant applications in the Scottish Offshore Region. There are no statutory requirements for consultation during the pre-application stage for Section 36 consent applications; however, the principles of the PAC Regulations will be followed for all components of the Green Volt Offshore windfarm (below MHWS).

Public consultation will be carried out for the offshore elements at the same events to give 3rd parties a full understanding of the whole project.

The PAC Regulations require Green Volt to notify the Maritime and Coastguard Agency (MCA), Northern Lighthouse Board (NLB), NatureScot, Scottish Environment Protection Agency (SEPA), and any other stakeholder as requested by MS-LOT. Green Volt, as the applicant, must hold at least one pre-application event at which these bodies are notified, and members of the public may provide comments to the applicant. Applicants must publish in a local newspaper a notice containing a description of the activity, detail where further information may be obtained, the date and place of the event, how and when comments should be submitted to the applicant. A PAC report must be submitted alongside the marine licence application.

3.7 The Habitats and Birds Directive and Associated Regulations

The Council Directive 92/43/EEC (the Habitats Directive) was adopted in 1992, providing a means for the EU to meet its obligations under the Bern Convention. The aim of the Directive is to maintain or restore natural habitats and wild species listed on the Annexes at a favourable conservation status. This protection is granted through the designation of European Sites (now known as the 'UK National site network[2]') and European Protected Species (EPS).

The European Directive (2009/147/EC) on the conservation of wild birds (The Birds Directive) provides a framework for the conservation and management of wild birds within Europe. The Directive affords rare and vulnerable species listed under Annex I of the Directive, and regularly occurring migratory species, protection through the identification and designation of Special Protection Areas (SPAs).

The Directives have been transposed into Scottish Law by various regulations, those of relevance to the Project include:

- the Conservation (Natural Habitats &c.) Regulations 1994 (as amended);
- the Conservation of Habitats and Species Regulations 2017; and
- the Conservation of Offshore Marine Habitats and Species Regulations 2017 (which apply to marine licences and Section 36 applications within Scottish waters beyond 12 nm).

These are hereafter referred to as the Habitats Regulations.

The Habitats Regulations require that where a plan or project that is not directly connected with, or necessary to the management of a European site, but likely to have a significant effect, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. A separate HRA Screening report has been prepared alongside this Scoping report.

[2] *The UK National site network is made up of SACs and SPAs designated at various points in time before exit day (i.e., UK sites that formed part of the EU's Natura 2000 network prior to exit day), and any sites designated under the Habitats Regulations after exit day.*

3.8 European Protected Species (EPS) Licensing

EPS are animals and plants (species listed in Annex IV of the Habitats Directive) that are afforded protection under the Habitats Regulations. If any activity is likely to cause disturbance or injury to an EPS a licence is required to undertake the activity legally.

Activities which can be licenced under EPS licences include those such as subsea noise disturbance to marine mammals due to piling construction activities. EPS licences are obtained from NatureScot or the Scottish Ministers, depending on the reason for the licence application. Although the grant of EPS licences is separate to the Section 36 and marine licence application process, it can be considered in parallel by Marine Scotland in order to constrict timelines.

Should additional pre-construction licences be required, these will be discussed and agreed with the relevant consenting authority during the pre-construction phase of the Green Volt Offshore Windfarm.

3.9 Decommissioning

Sections 105 to 114 of the Energy Act 2004 (as amended by the Energy Act 2008 and the Scotland Act 2016) (hereafter referred to as the Energy Act) contain statutory requirements in relation to the decommissioning of offshore renewable energy installations (OREI) and their related electricity lines. Under the terms of the Energy Act, Scottish Ministers may require a person who is responsible for these installations or lines in Scottish Waters or in a Scottish part of a REZ to prepare (and carry out) a costed decommissioning programme for submission to and approval by Scottish Ministers (Marine Scotland, 2020).

Scottish Ministers have the power to determine specific approaches to decommissioning, including stipulating what form, timing and size of financial securities are required. The expected content of a decommissioning programme includes decommissioning standards, financial security, residual liability, and industry cooperation and collaboration.

The draft Offshore Renewable energy decommissioning guidance states that "an indication of the decommissioning proposals should be included as part of the statutory consenting or licensing process so that the feasibility of removing the infrastructure can be assessed as part of the application process" (Scottish Government, 2019). Questions set out as part of this consultation state that the Scottish Government "aims to ensure that all future offshore renewable energy installations have an approved decommissioning programme in place prior to construction, as this will help manage the risk of projects going into the water without proper plans in place for removal" (Scottish Government, 2019)".

The scope of decommissioning requirements in Scotland is between the MLWS mark and the seaward limits of the territorial waters, including coastal water and the Scottish part of the REZ. The Energy Act does not cover the intertidal zone; however, decommissioning of infrastructure within the intertidal zone should be carried out under any conditions attached to a Marine Licence (under the Marine Scotland Act 2010).

4 Approach to Scoping and EIA

4.1 Introduction

This section describes the methodology that will be applied to the Green Volt Offshore Windfarm EIA. It outlines the methodology for the identification and evaluation of potential likely significant environmental effects (as defined in the EIA Regulations) and presents the proposed methodology for the identification and evaluation of potential cumulative and inter-related impacts, which includes due consideration of potential transboundary effects. A systematic and auditable evidence-based approach will be followed to evaluate and interpret the potential effects on physical, biological and human receptors.

The EIA is an assessment of the potential impacts of the development could have on the environment and identification of key receptors. These potential impacts can be positive or negative. The scoping report identifies the significant environmental effects which may occur and what outline mitigation methods or management can be used to reduce or removed these impacts to an acceptable level.

The EIA process is a systematic and on-going process that continues throughout the development phase until construction is complete. The process involves a detailed understanding of both the project and the environment that the systems are to be installed in, and the significance of these effects on the receptors within this area of impact from the development.

4.2 Guidance and Best Practice

Current best practice guidelines for methodologies to establish baseline conditions of offshore windfarm sites have developed from experience gained through various offshore windfarm developments throughout the UK. Statutory bodies, conservation advisors, trade associations and Collaborative Offshore Wind Research into the Environment (COWRIE) have all published a range of best practice and guidance documents and these have been used to facilitate the development of Scottish specific best practice methodologies.

However, these guidelines have been written for the application to fixed structures, large scale windfarm developments, and not for floating offshore windfarm projects. It is assumed that the requirements for a floating offshore scheme will be limited to a more appropriate level.

NatureScot has held best practice and ‘sharing good practice’ seminars, with the participation of stakeholders and potential offshore windfarm developers, with the aim to facilitate development of best practice within the Scottish Waters and review applicable lessons learnt from elsewhere. The context of these seminars has been the differences expected between the sensitivities of developing windfarms within 45 km of the Scottish coast and the projects located a significant distance (>45 km) from the Scottish coastline.

The following guidance and best practice documents have been developed to assist the EIA process:

- Marine Scotland Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy Applications (Marine Scotland, 2018b);
- Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- Environmental impact assessment for offshore renewable energy projects (British Standards Institute (BSI), 2015);

- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Centre for Environment, Fisheries and Aquaculture Science (Cefas), 2012);
- A Review of Assessment Methodologies for Offshore Wind Farms (Collaborative Offshore Wind Research Into The Environment (COWRIE) METH-08-08) (Maclean et al., 2009);
- IEMA Environmental Impact Assessment Guide to Shaping Quality Development (IEMA, 2015); and
- Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (The Planning Inspectorate, 2019).

4.3 Overview of the EIA Process

The EIA process can be broadly summarised as having the following steps:

- Scoping (i.e., this report): the applicant requests a Scoping Opinion form the Scottish Ministers through the production of a Scoping Report.
- Pre-application consultation: the applicant is required to conduct PAC as required under the PAC regulations (Section 3.6).
- EIA Report preparation: this constitutes the bulk of the EIA process and pulls together the outcomes of the assessment of potential, or likely significant effects from the Project on the environment during the construction, operation & maintenance, and decommissioning stages of the Project lifecycle in combination with responses to the consultation process.
- Determination: the competent authority will examine all the documentation provided during the application process and reach a reasoned conclusion on the significant effects of the Project on the environment. The environmental information, and the conclusions reached, must be taken into account by the competent authority in deciding whether or not to give consent for the development. The competent authority must also consider whether any monitoring measures are appropriate.
- Decision notice: the decision reached by the competent authority during the determination process must be published, through the form of a 'decision notice' that is made available to the public and consultation bodies. The decision notice incorporates the competent authority's reasoned conclusions on the significance of effects of the development on the environment.

4.3.1 Consultation and Stakeholder Engagement

4.3.1.1 Engagement to date

Green Volt has engaged in early discussions with MS-LOT and NatureScot to discuss the proposed Project and to support the development of this Offshore Scoping Report.

4.3.1.2 Future Engagement

Green Volt is fully committed to a thorough engagement process with regulators, marine stakeholders and local communities aiming to ensure that stakeholders are consulted and informed of developments during, and beyond, the EIA process for Green Volt.

This scoping report aims to introduce the proposals for Green Volt Offshore Windfarm and to outline the proposed approach to the EIA, including its scope, methodologies, assessments and outputs. It also aims to present what Green Volt consider to be the main issues and topics that must be addressed in the EIA. For this purpose, the contents of this Report will be shared with the consultees identified in Annex A. Key areas of the EIA consultation appropriate for each of the consultees are also shown in Annex A. However, this list is not exhaustive, and it is likely that as stakeholder engagement progresses, other organisations may be consulted, especially at a more local level.

Green Volt will develop a Project Communications Plan that will guide stakeholder consultation for all phases of the project, including a communications protocol and strategy for key stakeholders. Communications with statutory consultees, the public, community bodies, elected representatives and the media for Green Volt Offshore windfarm will be co-ordinated by the project team. This consultation process is likely to include websites, public exhibitions, meetings and press releases. The outcomes of consultation with the public will be recorded in appropriate sections of the EIA Report.

4.3.1.3 PAC Event

Section 3.6 provides the legislative basis for undertaking PAC. The PAC Regulations require Applicants for certain types of Developments (of which the Green Volt Offshore Windfarm falls under the PAC Regulations) to notify, no less than 12 weeks in advance of submission of the application, the MCA, NLB, SNH, SEPA, and any other stakeholder as identified by MS-LOT.

Applicants must also hold at least one event at which both the stakeholders listed above, and members of the public, may provide comments to the Applicant. The date for the PAC event for the proposed Green Volt Project is to be determined. Details of the PAC Event will be published in all relevant local newspapers.

A PAC Report will be prepared and submitted with the marine licence application.

4.4 Assessment Methodology

This section describes the EIA assessment methodology for the development. It outlines the methodology for identification and evaluation of potential likely significant environmental effects and presents methodology for the identification and evaluation of potential cumulative and inter-related impacts across different receptor groups.

Within the Offshore EIA Report, the assessment of each topic (e.g., physical processes, marine mammals, infrastructure and other users etc.) will be included in a separate chapter. A list of the topic chapters that will be included in the Offshore EIA Report is outlined below. Within each of the topic chapters, the following matters will be considered:

- identification of the study area for the topic-specific assessments;
- description of the planning policy and guidance context;
- summary of consultation activity, including comments received in the Scoping Opinion and PAC;
- description of the environmental baseline conditions; and
- presentation of impact assessment, which includes:
    - identification of the maximum design scenario for each impact assessment;
    - a description of the measures adopted as part of the Green Volt Offshore Windfarm, including mitigation and design measures which seek to prevent, reduce or offset environmental effects; and
    - identification of likely impacts and assessment of the significance of identified effects, taking into account any mitigation measures adopted as part of the Green Volt Offshore windfarm.
- Identification of any further mitigation measures required in respect of LSE (in addition to those measures adopted as part of the Project), together with consideration of any residual effects;
- identification of any future monitoring required;

- assessment of any cumulative effects with other major developments, including those that are proposed, consented and under construction (including, where applicable, those projects, plans or activities that are currently operational that were not operational when baseline data was collected); and
- assessment of any transboundary effects (i.e., effects on other European Economic Area (EEA) states).

Inter-related effects (i.e., inter-relationships between environmental topic areas) will be assessed in a separate standalone chapter which will consider the impacts of the Development on each of the identified receptor groups.

4.4.1 Existing Evidence

The development site is located in on top of the former Ettrick and Blackbird oil field developments, which has provided over 20 years of existing site data covering all elements of the offshore EIA assessment process. Ongoing decommissioning work on the two sites has provided significant opportunity to undertake extensive early phase site survey of the entire development area to assess the seabed and also target potential Annex 1 targets across the site. No commercial fishing across the two oil fields for over 20 years has ensure the seabed has remained undisturbed outside the zones of subsea development (oil wells and pipelines etc).

Additionally the consented North Connect interconnector cable corridor runs through the development site and follows the Green Volt export cable corridor to shore ; therefore, the entire primary export cable corridor to a potential onshore landing location has undergone recent and extensive survey to assess all potential receptors. This consented project data will be used to support the Green Volt export cable corridor assessment.

This has been used extensively within this scoping report to:

- provide extensive data, both temporal and spatially, across the entire development site and export cable route options;
- support scoping out impacts where there is clear evidence of lack of receptor-impact pathway; and
- where impacts are proposed to be scoped into further assessment in the offshore EIA Report, to draw upon the pre-existing evidence base where appropriate.

4.4.2 Assessment of Impacts

The approach the EIA team will take to making balanced assessments will be guided by EIA and technical specialists using available data, new data, experience and expert judgement. In order to provide a consistent framework and system of common tools and terms, where appropriate, a matrix approach will be used to frame and present the judgements made. However, it should be noted that for each topic of the EIA, the latest guidance or best practice will be used and, therefore, definitions of sensitivity and magnitude of impact will be tailored to each receptor. As required by the EIA Regulations, only effects that are likely to be significant require detailed assessment.

The impact assessment will consider the potential for impacts during the construction, operation and decommissioning of the Green Volt Offshore Windfarm.

4.4.2.1 Determining Receptor Sensitivity and Value

The sensitivity of a receptor is determined through its ability to accommodate change and on its ability to recover if it is affected. Receptor sensitivity will be assigned on the basis of species-specific adaptability, tolerance, and recoverability, when exposed to a potential impact. The following parameters will be taken into account:

- Timing of the impact: whether impacts overlap with critical periods of the receptor, e.g., life-stages or seasons for ecological receptors; and
- Probability of the receptor-effect interaction occurring (e.g., vulnerability).

The 'value' of the receptor forms an important element within the assessment, for instance, if the receptor is a protected species or habitat or has an economic value. It is important to understand that high value and high sensitivity are not necessarily linked within a particular impact. A receptor could be of high value but have a low or negligible physical/ecological sensitivity to an effect. Similarly, low value does not equate to low sensitivity and is judged on a receptor-by-receptor basis.

Receptor value considers whether, for example, the receptor is rare, has protected or threatened status, importance at local, regional, national or international scale, and in the case of biological receptors whether the receptor has a key role in the ecosystem function.

The overall receptor sensitivity is, therefore, determined by considering a combination of value, adaptability, tolerance and recoverability as well as applying professional judgement and/or past experience. Expert judgement is particularly important when determining the sensitivity of receptors. For instance, an Annex II species (under the Habitats Directive) would have a high value, but if it was highly tolerant of an effect or had high recoverability it would follow that the sensitivity in this instance should reflect this.

4.4.2.2 Predicting Magnitude of Impacts

The impact magnitude is determined by the interaction between the scale of the effect in time, area, intensity and the sensitivity of the affected receptor. It is important to note that a change resulting from a proposed development can be positive or negative and this is reflected in Table 4.1 which sets out the criteria used to determine the magnitude of change.

With respect to duration of potential impacts, those associated with construction will be considered to be short term, occurring over a maximum of 2 years following construction. Impacts associated with operation will be considered longer term, occurring over the operational lifetime of the Green Volt Offshore windfarm.

4.4.2.3 Evaluation of Significance

The significance of potential impacts will be defined by considering receptor sensitivity in combination with the magnitude of a given impact. Where there is a lack of suitable data to quantitatively assess impacts for the species under consideration, the assessment will be informed by professional experience and judgement.

Subsequent to establishing the receptor sensitivity and magnitude of effect, the impact significance will be predicted by using quantitative or qualitative criteria, as appropriate to ensure a robust assessment. Where possible a matrix such as the one presented in Table 4.1 will be used to aid assessment of impact significance based on expert judgement, latest guidance and any specific input from consultation. The matrix is seen as a framework to aid understanding of how a judgement has been reached from the narrative of each impact assessment and it is not a prescriptive formulaic method. To some extent, defining impact significance is qualitative and reliant on professional experience, interpretation and judgement.

A description of the approach to impact assessment and the interpretation of significance levels will be provided within each section of the ES. This approach will ensure that the definition of impacts is transparent and relevant to each topic under consideration.

For the purposes of the EIA, major and moderate adverse impacts are deemed to be significant, and, as such, may require mitigation. Whilst minor impacts are not significant in their own right, these may contribute to significant impacts cumulatively or through interactions.

Table 4.1:Matrix for evaluating the significance of an impact

Sensitivity	Magnitude				
	High	Medium	Low	Negligible	No Change
High	Major	Major	Moderate	Minor	No impact
Medium	Major	Moderate	Minor	Negligible	No impact
Low	Moderate	Minor	Minor	Negligible	No impact
Negligible	Minor	Negligible	Negligible	Negligible	No impact

Through use of this matrix, an assessment of the significance of an impact would be made in accordance with the definitions in Table 4.2.

Table 4.2: Definitions of impact significance

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No Impact	No change in receptor condition; therefore, no impact

4.4.2.4 Mitigation and Monitoring

Where an impact assessment identifies that an aspect of the project is likely to give rise to significant environmental impacts, mitigation measures will be proposed, in order to avoid impacts or reduce them to acceptable levels.

Mitigation will take place in the following hierarchy, where the first is not feasible due to constraints, including, engineering, technology or geology, the next measure will be engaged.

1 The proposed Project design will aim to avoid placing permanent infrastructure or having temporary working areas within protected sites, where possible.

2 If avoidance of protected sites is not possible, best endeavours will be made to design the proposed Project to avoid direct impact on the specified features of interest within protected sites via specific construction and decommissioning methods, where possible.

3 Where the feature is not static, the design of the infrastructure of the proposed Project must, where practicable, minimise impact on mobile species, therefore reducing the interaction and harm.

4 Where avoidance of features of interest are not possible, mitigation measure will be developed for construction, operation and decommissioning to minimise effects, such as work schedule, techniques and working areas, and agree reinstatement of temporary works with regulatory authorities, offsetting or enhancement measures.

It is important to note that the mitigation measures applied should be proportionate to the scale of the impact predicted. Appropriate mitigation measures will be discussed and agreed, where possible, with the relevant regulatory authorities and stakeholders.

In some cases, in order to ensure that the mitigation measures are successful or where there is significant uncertainty with respect to important receptors, monitoring may be appropriate. Monitoring programmes are most commonly required during and shortly after construction but can also be prior to and during operations. The nature of any monitoring will be dependent on the nature of the effect or mitigation measure under inspection.

4.4.2.5 Inter-Related Effects

The impact assessment will consider the inter-relationship of impacts on individual receptors. The objective will be to identify where the accumulation of residual impacts on a single receptor, and the relationship between those impacts, gives rise to a need for additional mitigation. When considering the potential for impacts to inter-relate it is assumed that any residual effect determined as having no impact will not result in a significant inter-relationship when combined with other effects on receptors. However, where a series of negligible or greater residual impacts are identified, they will be considered further.

4.4.2.6 Cumulative Effects

The EIA Regulations state that cumulative effects should be addressed within an EIA. Engagement with MS-LOT will identify which plans/projects/on-going activities should be included in the in-combination element of the cumulative effects assessment. MS-LOT guidance states projects for consideration will include those that are:

- already constructed;
- under construction;
- permitted application(s), but not yet implemented;
- submitted application(s) not yet determined; and
- plans and projects which are “reasonably foreseeable” (i.e. developments that are being planned, including, for example, offshore renewable energy projects which have a Crown Estate Scotland AfL, offshore renewable energy projects that have been scoped).

Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment will be included in the cumulative effects assessment. Projects which are sufficiently implemented during the site characterisation for the Green Volt windfarm will be considered as part of the baseline for the EIA. Where possible Green Volt will seek to agree with stakeholders the use of as-built project parameter information (if available) as opposed to consented parameters to reduce over-precaution in the cumulative assessment.

For some topics (where for example the receptors include highly mobile or migratory species, fishing or shipping) the cumulative effects assessment will have a large geographic scale and involve in many plans and projects, for others where receptors (or impact ranges) are more spatially fixed the cumulative effects assessment will be narrower. The scope of the cumulative effects assessment will therefore be established on a topic by topic basis with the relevant consultees as the EIA progresses.

The offshore EIA will consider potential offshore cumulative effects only. The onshore cumulative effects of this project will not be assessed as part of the offshore consenting process. Offshore cumulative impacts may come from interactions with the following activities and industries:

Other offshore wind farms;

- Aggregate extraction and dredging;
- Licensed disposal sites;
- Navigation and shipping;
- Commercial fisheries;
- Sub-sea cables and pipelines;
- Potential port and harbour development;
- Oil and gas activities;
- Carbon Capture Storage; and
- Unexploded Ordinance (UXO) clearance.

Onshore plans or projects that may be considered include (but are not limited to):

- Other offshore wind farm infrastructure;
- Other energy generation infrastructure;
- Building and / or housing developments;
- Installation or upgrade of roads;
- Installation or upgrade of cables and pipelines; and
- Coastal protection works.

4.4.2.7 Transboundary Effects

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

The procedures involve providing information to the Member State and for the Scottish Ministers to enter into consultation with that State regarding the significant impacts of the development and the associated mitigation measures.

Transboundary impacts, like cumulative impacts, are considered on a topic-by-topic basis for offshore topics. In terms of the Green Volt Offshore Windfarm, transboundary impacts will relate primarily to projects that may affect mobile species, and to projects that are located close to the national boundaries, or to areas administered by other relevant authorities.

5 The Physical Environment

This chapter was produced by Dr Richard Wakefield of Flotation Energy.

The potential for effects on the physical environment arises from the physical existence of the windfarm, the construction methods adopted, and the materials used in the development. As a floating offshore structure will have a larger surface presence than a traditional offshore wind turbine structure the utilisation of the structure by nature is likely to be increased.

The physical environment data obtained from the Ettrick and Blackbeard oil and gas developments will be used to understand the possible impact the cable route and mooring could have on the seabed and will be used to identify the location of large-scale bed forms and hard rock outcrops, near to the export cable landing location. Additionally, the bathymetry data will be used to precisely chart seabed within the site and export cable corridors to Buzzard and also the main export cable corridor to shore and the associated cable landing location and construction method (expected to be undertaken via HDD in all current primary options considered to reduce the environmental impact), but if this is not possible to undertake this approach to due engineering considerations an open trench approach will be considered and included within the EIA assessment.

Detailed knowledge of the inshore coastal zone for the proposed export cable route to shore will utilised the extensive data and reporting from the consented NorthConnect cable corridor and as this follows the primary Green Volt export cable route to Peterhead, this evidence and associated survey data will be utilised to support the export cable to shore assessment in the EIA.

The physical impact on the environment during construction is significantly reduced due to lack of impact from piling operations and the ability to undertake a significant quantity of the construction process at an offsite port location prior to placement at site.

The potential for effects of the project on the physical environment and the strategy to assess the impact of such effects will be based on the following assessment process.

All data from the previous Ettrick and Blackbird site surveys (2006, 2007, 2008, 2009, 2010, 2011, 2012, 2014 and 2021) have been used to assessment potential physical environment impacts from the development. This data range spans 15 years, with the most recent 2021 full site decommissioning survey being used to provide a final debris clearance and environmental survey of the entire Green Volt Project Area. This survey, carried out in August-September 2021, will form the project baseline for the development going forward and no additional environmental surveys are planned to support the EIA process for the development area.

It is not expected that a coastal processes study will be required as part of this project due to the distance from shore there will not be any measurable impact on the shoreline to the southwest of the site as this is predominantly a hard rock coastline with significant water depths adjacent to the coast.

5.1 Bathymetry

5.1.1 Data and Information Sources

Significant consultation with the previous site operators has been undertaken and all available data relating to oil and gas development has been obtained.

The seabed of the development area has been extensively surveyed as part of the past oil and gas activity located on the Ettrick and Blackbird site, including work currently being undertaken as part of the decommissioning programme of work in 2021 (Table 5.1) summarises some of the available bathymetric environment data.

Table 5.1 Baseline information – Bathymetry

Type/description of data	Source	Status
Bathymetry	Extensive bathymetric site survey from O&G development	Obtained
	United Kingdom Hydrographic Office (UKHO) Admiralty Chart data (Easychart) & UKHO INSPIRE bathymetric data	Obtained

5.1.2 Existing Environment

The bathymetry of the Project Area is generally a flat seabed with no significant underwater slopes or features. The Project Area is located in approximately 110 m LAT of water (range 100 m to 115 m) (Figure 5.1).

The export cable routes will extend back to the Aberdeenshire shoreline where they will connect to the onshore electrical cables at the cable landing location. The route back to shore will follow the NorthConnect cable corridor back to the 12 nm and will collocated next to the consented interconnector corridor via appropriate co-location agreements. The route to the 12 nm limit is along gently sloping seabed (UKHO bathymetric map) which very gradually rises as it gets closer to the 12 nm limit. At this point the export cable route will either follow the NorthConnect cable corridor to a landing point to the south of Peterhead or branch off to a cable landing location to the north of Peterhead. Both of these inshore options have a fairly gentle rise to the shoreline where a known underwater sharp rise is noted near to both potential cable route option areas.

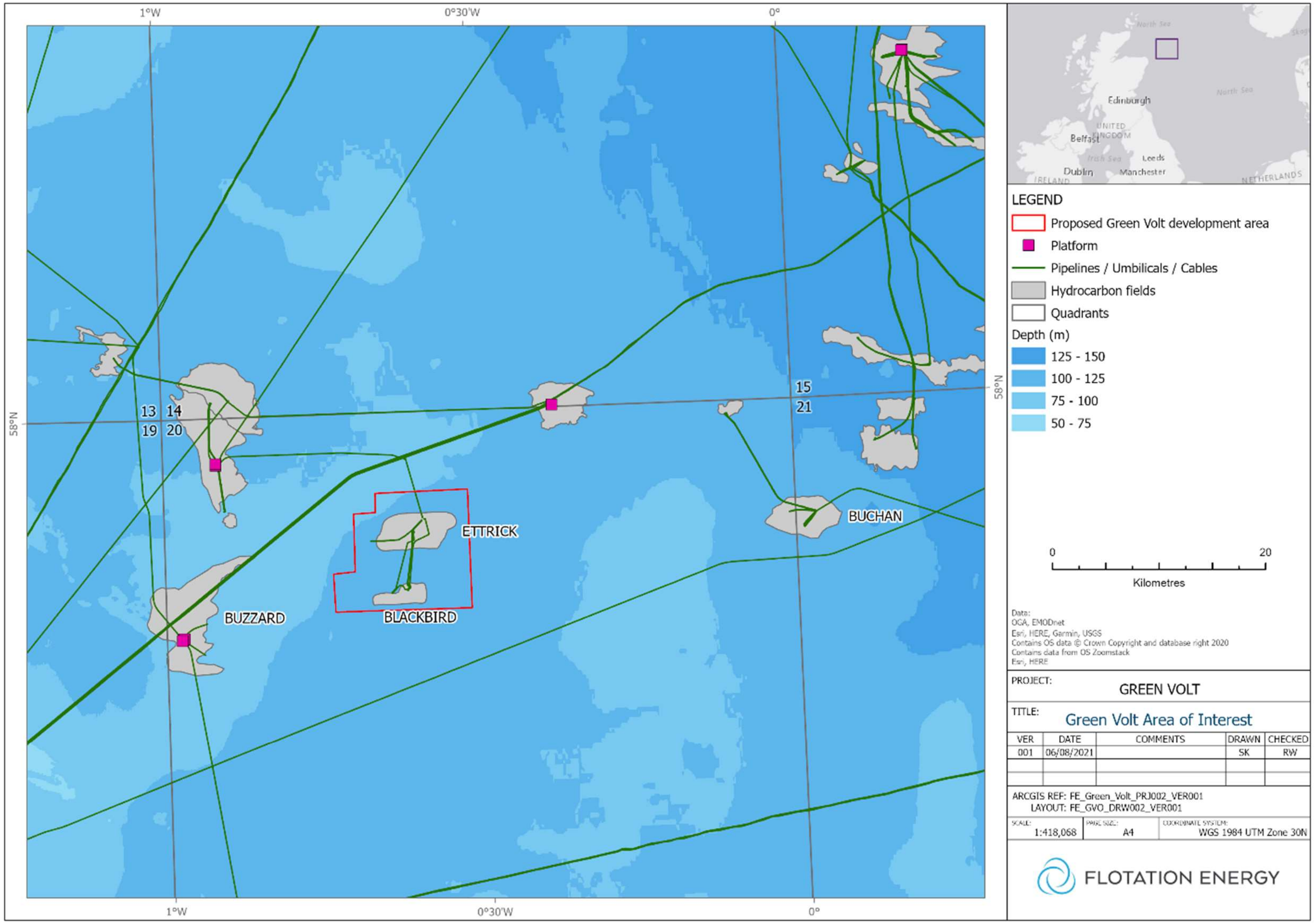


Figure 5.1 Bathymetry of development area (EMODNet).

5.1.2.1 Data Gaps

No data gaps have been identified within the baseline information outlined in this section for the windfarm site currently as this has been extensively mapped over 20 years and has been the subject of numerous oil and gas seabed activities (pipeline installation, rock protection, well heads, connection joints etc) and the impact from these installations has shown no change to the bathymetry over time from the multiple multibeam surveys that have been conducted. It would therefore be assumed that less intrusive floating offshore wind installations will have a lower potential to modify the seabed bathymetry and as the water depth is over 100m deep there is no potential for the bathymetry to change by the 5% or 5 m due to the project in the development area.

As described within the detailed North Connect cable assessment, no rock armour or material change to the water depth will be required for the majority of the export cable route to shore. As it is expected that HDD will be used to connect the offshore export cable to shore, the cable will likely exit the seabed in water depths over 20m and will be trenched and covered by an appropriate rock protection in the more energetic nearshore environment. It is expected that this will be similar to the North Connect and Kincardine approach to laying the inshore cable, where the associated rock protection does not exceed the noted 5% change to bathymetry. However, as part of the assessment process this will be reviewed following the inshore export cable survey (inside 12 nm) and the results will be used to support in the inshore export cable route assessment and will be included in the EIA.

The export cable to the offshore oil gas platform is located in water depths over 90m and therefore after installation and burial it is expected that no change to bathymetry will be observed and that the 5% change to bathymetry will not be exceeded.

5.1.3 Potential Impacts on Change to Bathymetry

Possible impacts relating to the potential changes to the bathymetry of the area are considered in Table 5.2.

Table 5.2 Summary of potential impacts to bathymetry (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Changes to bathymetry (windfarm site)	x	x	x
Changes to bathymetry (export cable) outside 12nm	x	x	x
Changes to bathymetry (export cable) inside 12nm	✓	✓	x
Changes to bathymetry (export cable to oil platform)	x	x	x

Due to the location of the project the potential impact on the physical environment is very low. As the site is located 75 km offshore from the Scottish coastline and the previous evidence from the oil and gas equipment installed on the seabed at this location, it has been demonstrated that no or extremely limited impact on the physical environment, the potential to impact on the seabed or the distance coastline are insignificant. Therefore, additional works on bathymetry have been scoped out of the EIA process for the windfarm site, export cable to the oil platform and also the export cable to shore to the 12nm point.

The export cable route inside 12nm will be assessed further following the results of the inshore survey of and the output will be helped to assess the potential change to bathymetry in this zone within the EIA report.

5.2 Geology, Geomorphology and Offshore Sediments

5.2.1 Data and Information Sources

Significant consultation with the previous site operators has been undertaken and all available data relating to the oil and gas developments have been obtained.

The seabed of the Windfarm Site has been extensively surveyed as part of the past oil and gas activity located on the Ettrick and Blackbird site, including work currently being undertaken as part of the decommissioning programme of work in 2021.

Table 5.3 summarises some of the available geology, geomorphology and offshore sediments data.

Table 5.3 Baseline information – Physical Environment

Type/description of data	Source	Status
Geology, geomorphology and offshore sediments	Extensive site survey data from O&G (sediment sampling, drop down camera and video)	Obtained
	British Geological Survey	Obtained
	Marine Scotland	Obtained
	EMODnet – Bedrock geology and sesabed sediment	Obtained
	Extensive site survey and Geotech/geophysical site surveys for all of O&G development areas	Obtained
	BGS – maps and online borehole logs	Obtained
	BGS – Offshore bore hole logs	Obtained
	Marine Scotland	Obtained

5.2.2 Existing Environment

The eastern area is formed of the Swatchway Formation with patches of Witch Ground Formation overlying. The Swatchway Formation is closely linked to the Coal Pit Formation and comprises disturbed sands, silts and muds. The Witch Ground Formation is generally formed of silty clays and sands and is characterised by 'pockmarks' which are likely formed by undersea gas escape.

Along the export cable corridor, the Quaternary geology largely comprises of the Forth Formation, characterised by marine sands and soft muds ranging from 5-50 m thick, with the coastal area comprising more SAND and GRAVEL, overlying Tertiary interbedded. These are seen to outcrop in patches at the coast.

The quaternary formations in the vicinity of the Project Area exceeds 50 m in thickness, with it gradually decreasing as it approaches the Aberdeenshire coastline, as presented in Figure 5.2.

Recent seabed sediments are those deposited during the Holocene (approximately the last 15,000 years) and influenced by the rising sea levels since the most recent (Late Devensian) glaciation. Seabed sediments at the Project Area are predominantly sand or muddy sand. The Aberdeenshire coastline has a number of locations where there is known hard substrate located in the nearshore environment and then a gradual decrease in particle size further away from the coastline from gravelly sand to fine sand along the export cable corridors (Figure 5.3) which is a reflection of metocean conditions (increased current velocity closer to the Aberdeenshire coastline).

Figure 5.4 summarise some of the available oil and gas development data and shows the location of the relevant sampling stations associated within the Ettrick and Blackbird oil field development period that are described below. These sampling locations and survey data included here are tied back to the oil and gas field development and relate to the following locations using a 0.1 m^2 Day grab and the use of side scan sonar (SSS) to locate potential points of interest on the seabed for drop down camera assessments. Stations were positioned as:

- four stations at the drill centre;
- four stations at the FPSO centre;
- one station at the closest adjacent habitat change;
- one station at a clear habitat change within 1000 m or nearby historical wellhead;
- one at the remote injection well site with one at a nearby historic wellhead;
- two along each of the two potential pipeline routes; and
- one reference station, a minimum 2000 m from well / pipeline sampling stations in a similar sediment type and depth.

Unconsolidated sediments in the vicinity of the development area are very unlikely to be mobilised by the calculated current velocities noted at site. During the drop-down camera surveys, slight seabed ripples were noted, and these are likely to be due to large storm wave generated orbital current velocities. This can be assumed due to the water depth (110 m) and the evidence of long-term bioturbation of the bed sediments that intersect the small ripple formations which would discount the tidal current sediment mobility. Long term, large storm current velocities are likely to have gradually resulted in scour around the noted seabed objects (especially the large glacial drop stone recorded at site), but these are likely to be decadal or even multi-century scale sedimentary processes.

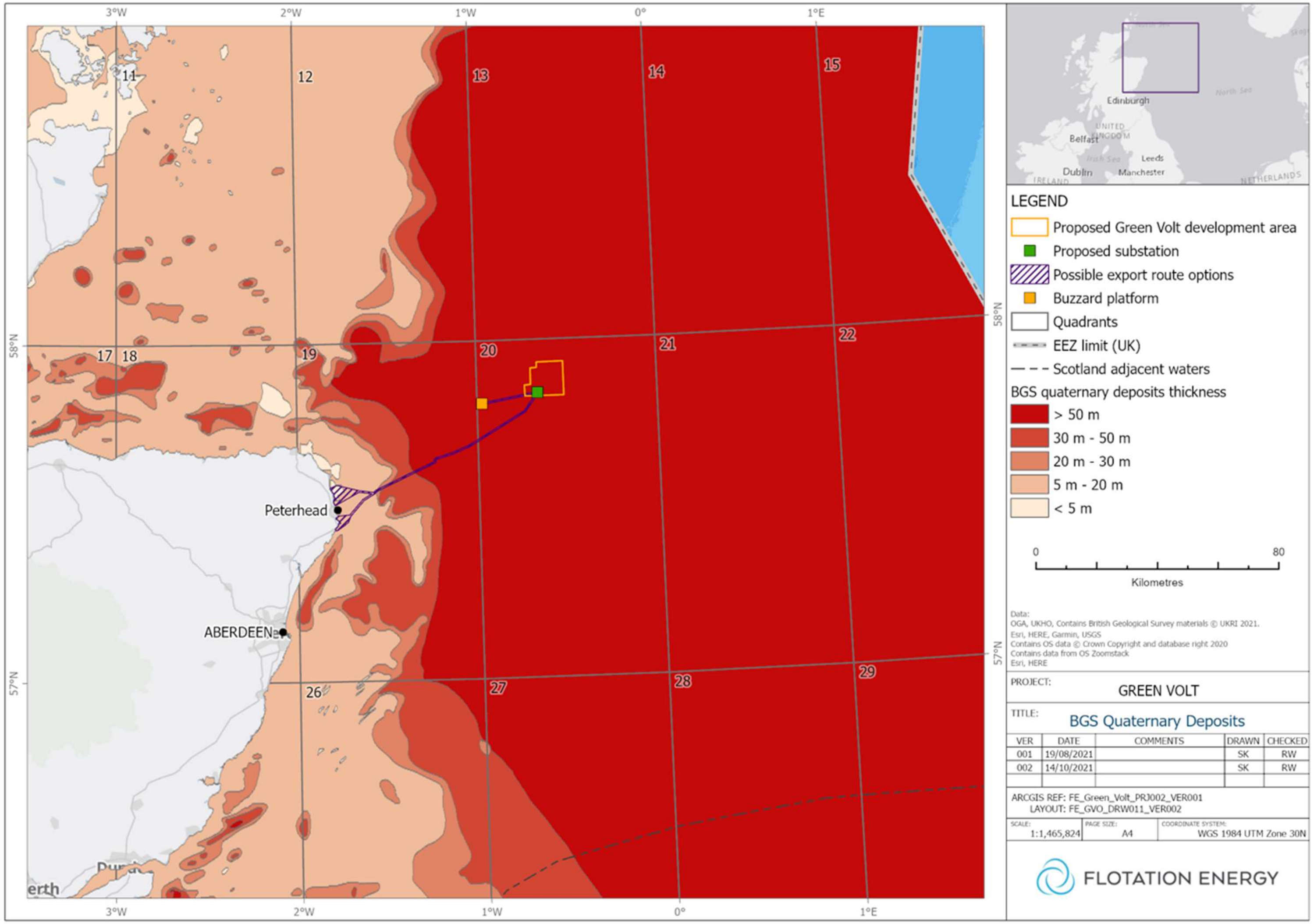


Figure 5.2 Thickness of Quaternary Deposits in the Vicinity of the Project Area and export cable route (BGS).

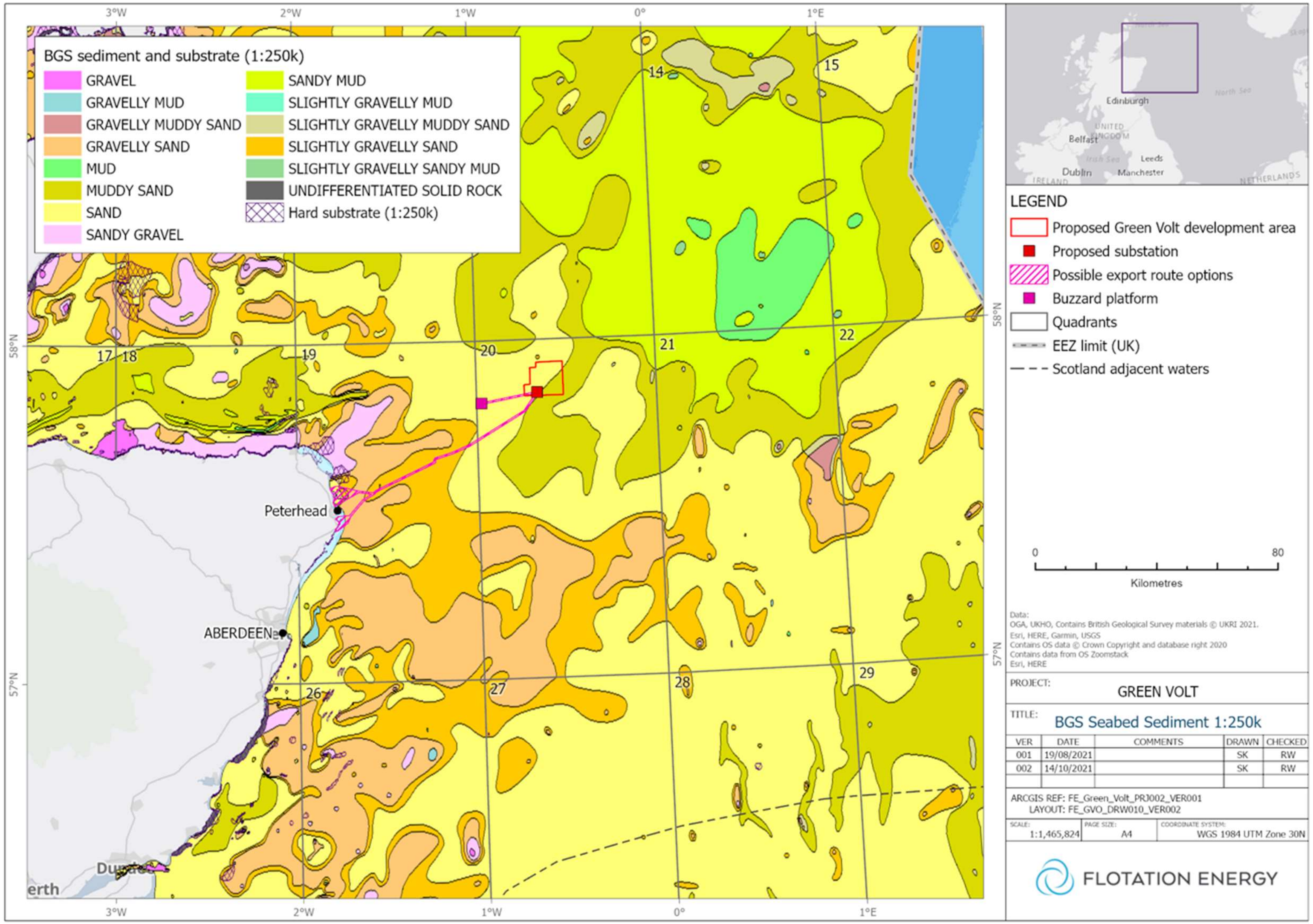


Figure 5.3 Seabed sediments in the vicinity of the development and the export cable corridor.

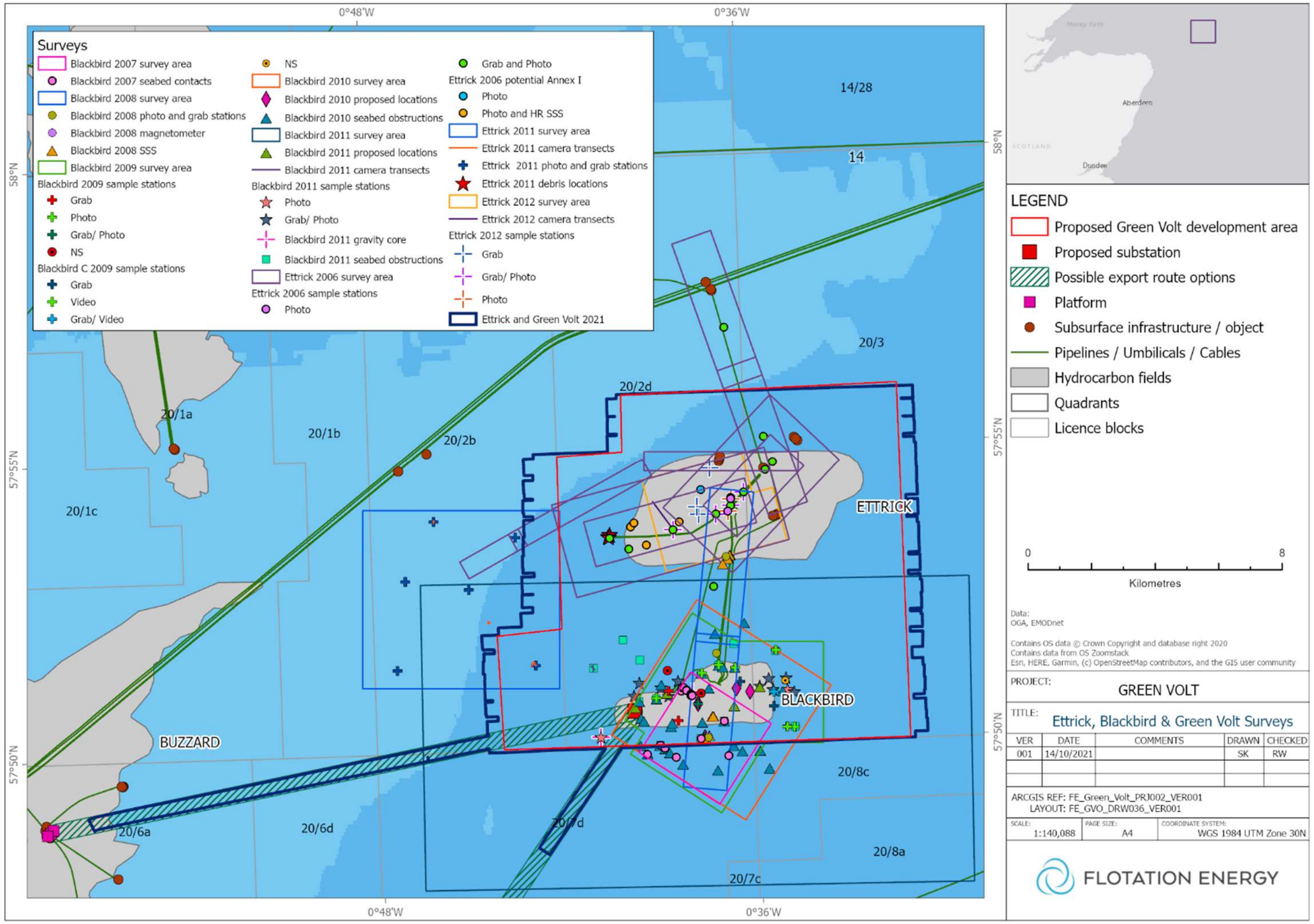


Figure 5.4 Location of all previous survey areas and sampling locations, including 2021 decommissioning survey of entire licence block area and export cable corridors to Buzzard and shore.

5.2.2.1 Southern Trench Marine Protected Area

The export cable to shore will pass through the southern section of the Southern Trench MPA (STMPA) and, therefore, this is reviewed in the following section. The STMPA is 49 km from the Windfarm Site and it is highly likely that the export cable corridor will pass through the southern section of the STMPA.

Table 5.4 contains the features and associated conservation objectives for the STMPA.

Table 5.4 Southern Trench MPA summary features

Summary of features and conservation objectives – Southern Trench MPA		
Feature	Protected Feature	Conservation Objective
Biodiversity	Burrowed mud	Conserve
Biodiversity	Minke whales	Conserve
Biodiversity	Fronts	Conserve
Biodiversity	Shelf deeps	Conserve
Geodiversity	Quaternary of Scotland (subglacial tunnel valleys and moraines)	Conserve
Geodiversity	Submarine mass movement	Conserve

There is no current energy generation activity within or adjacent to the STMPA. However, there is a consented route through the STMPA for the export cable for the Moray East offshore windfarm.

It is currently assumed that the Green Volt Offshore windfarm export cable route through the STMPA will require the following requirements:

- Survey the 12 nm of export cable within the STMPA, which is estimated to take approximately three days of effort.
- Any requirements for marine mammal survey would cover STMPA survey guidance recommendations.

The current options being considered for the export to shore cable route does not pass near to the main STMPA feature, which is a 58 km long, 9 km wide and 250 m deep trench that runs parallel to the north coast of Aberdeenshire/Moray council coast. The trench is considered to be a glacial feature, carved out during the last ice age and partially infilled with glacial marine sediments. The trench functions as a nursery ground for juvenile fish and the thick, soft mud covering the trench floor is home to an assortment of mud-loving animals. These include the Norway lobster and crabs that build their burrows in the mud, elegant seapens and tube anemones which rise out of the mud to filter food from passing water and squat lobsters on the mud's surface looking for food. As shown in Figure 5.5, the export cable route through the MPA predominantly passes through areas of gravelly sand, with some sections of slightly gravelly muddy sand and not the protected marine muds note as the protected feature of the STMPA which are more predominant in the norther section of the MPA. This will be confirmed by the proposed detailed inshore survey.

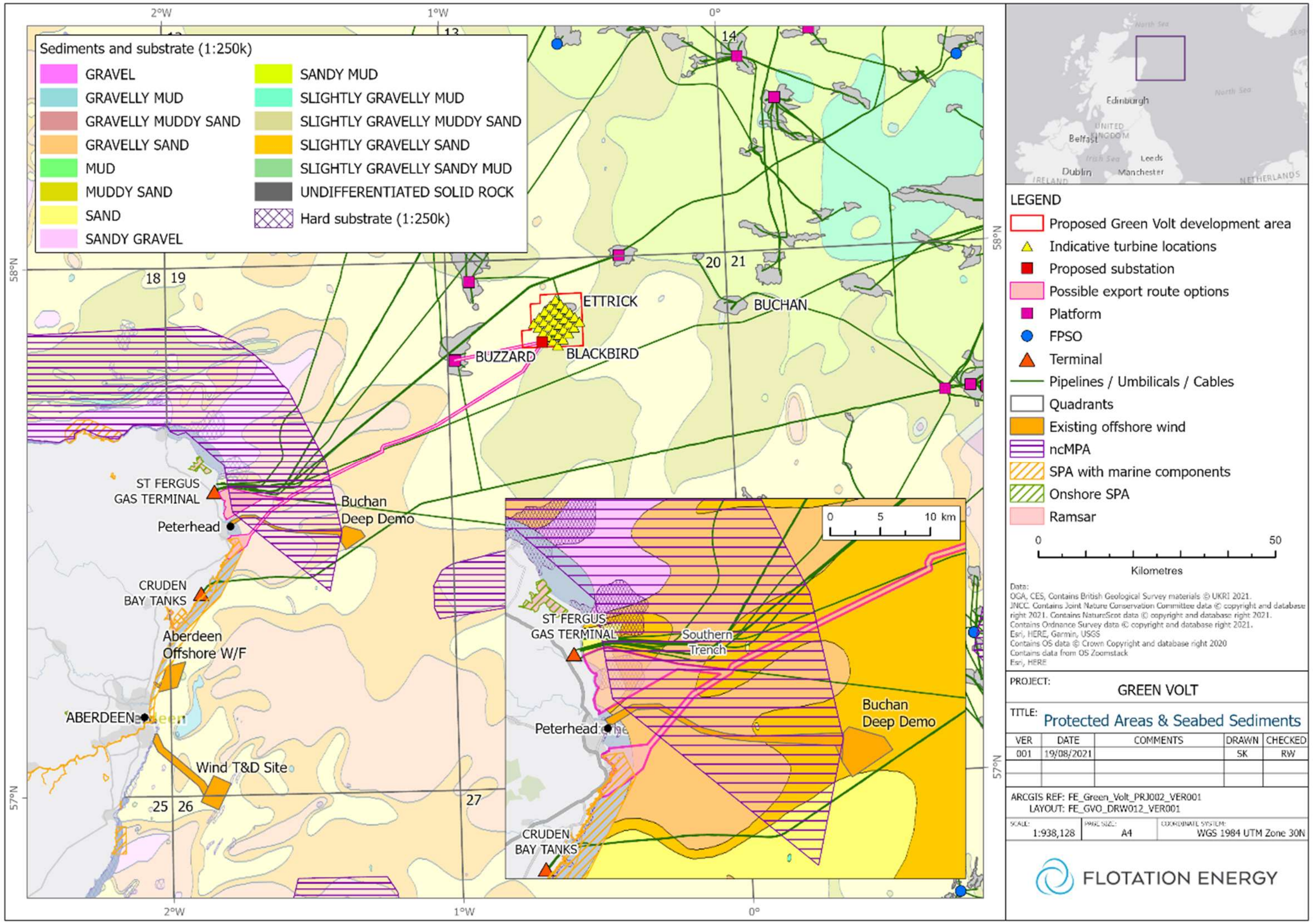


Figure 5.5 Proposed export cable route options through the Southern Trench MPA and surficial sediments (BGS 1:250,000 scale).

5.2.2.2 Data Gaps

No data gaps have been identified within the baseline information outlined in this section for the windfarm area, export cable to the oil platform and also the export cable to shore (outside 12nm). The inshore (inside 12nm) is subject to additional survey requirements and this will be used to confirm the export cable corridor and the potential impact on the seabed in this zone within the EIA report.

5.2.3 Potential Impacts

As noted above, there has been significant oil and gas activity at the windfarm site over the last 20 years and, therefore, the available data gathered during this period has confirmed that it is very unlikely for the installation of floating offshore wind equipment on the seabed will have any significant impact during the lifetime of the project, mainly due the water depth (>100 m) and the distance from shore. No noted scour or seabed movement has been identified during this period around the oil and gas installations on the seabed and no known remedial scour work has been undertaken on the site to protect this critical infrastructure.

Sediment samples have been collected across the windfarm site over a number of decades, including the summer 2021 decommissioning survey programme. Additional sediment samples and video mapping have been undertaken on the export cable route at regular spacing (approximately every 2 km) to the oil platform and the export cable to shore outside 12 nm and these will be used to help support the EIA report. Additional survey work inside 12 nm will also collect appropriate sediment and video sampling to support the EIA report and confirm the seabed sediment in this zone.

The potential impacts from the project during the construction, operation, and decommissioning phases are outlined below and summarised in Table 5.5.

Table 5.5 Summary of potential impacts to geology, geomorphology and offshore sediments (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Increases in suspended sediment	x	x	x
Seabed scour	x	x	x

As the site is located 75 km offshore from the Scottish coastline and the previous multiple survey evidence from the oil and gas equipment installed on the seabed at this location, it has been confirmed from site survey data that no likely sediment movement is expected (from reviewing the oil and gas subsea structures that have been located on the site for over 10 years), it has been demonstrated that no or extremely limited impact on the physical environment, the sediment climates on the seabed or the coastline are insignificant. Therefore, additional works on geology, geomorphology and offshore sediments have been scoped out of the EIA process.

Due to the distance from shore, the predominant sediment grain size (sand) of the seabed, low current speeds and the significant distance to any protected area from the windfarm area means that any short term suspended sediment generated during any phase of the windfarm operation will have an insignificant impact against any marine receptor as any mobilised bed sediment will rapidly fall out suspension within the close vicinity of the windfarm area and not be transported to any distant environmental receptors. Construction on the export cable to shore will produce some very localised, short term suspended sediments volumes during the construction phase and again this will have limited time period of impact on the surrounding marine environment. Any suspended sediment generated by the construction process is likely to be well below the normal marine dynamics effects seen in these shallower coastal zones (storm events and wave action) and those generated by other marine users in this area.

Under the EPS licence requirements, any impacts to marine mammals will be addressed. Any requirements for further survey would comply with STMPA survey guidance recommendations. Marine survey data from the NorthConnect cable route consent will be acquired to support the initial consent assessment as the two cable corridors are likely to be co-located within the same surveyed route.

5.3 Metocean Conditions

5.3.1 Data and Information Sources

Significant consultation with the previous site operators has been undertaken and all available data relating to oil and gas development has been obtained.

Table 5.6 summarises the available metocean environment data used in this Scoping Report.

Table 5.6 Baseline information – Metocean conditions

Type/description of data	Source	Status
Metocean data	Extensive site survey and metocean data from O&G development	Obtained
	UKHO Tidal stream data (Total Tide)	Obtained
	Marine Scotland	Obtained
	ECMWF ERA Model output	Obtained
	MEDIN data base	Obtained
	British Oceanographic Data Centre (BODC)	Obtained
	Meteorological Office (wave and wind data for European and UK models)	Obtained
	Wavenet directional waverider data collection	Obtained

5.3.2 Existing Environment

5.3.2.1 Waves

Mean annual wave height (2.01-2.25 m) has been obtained for the area and surrounding Scottish territorial water and this is shown in Figure 5.6 (ABPmer, 2017).

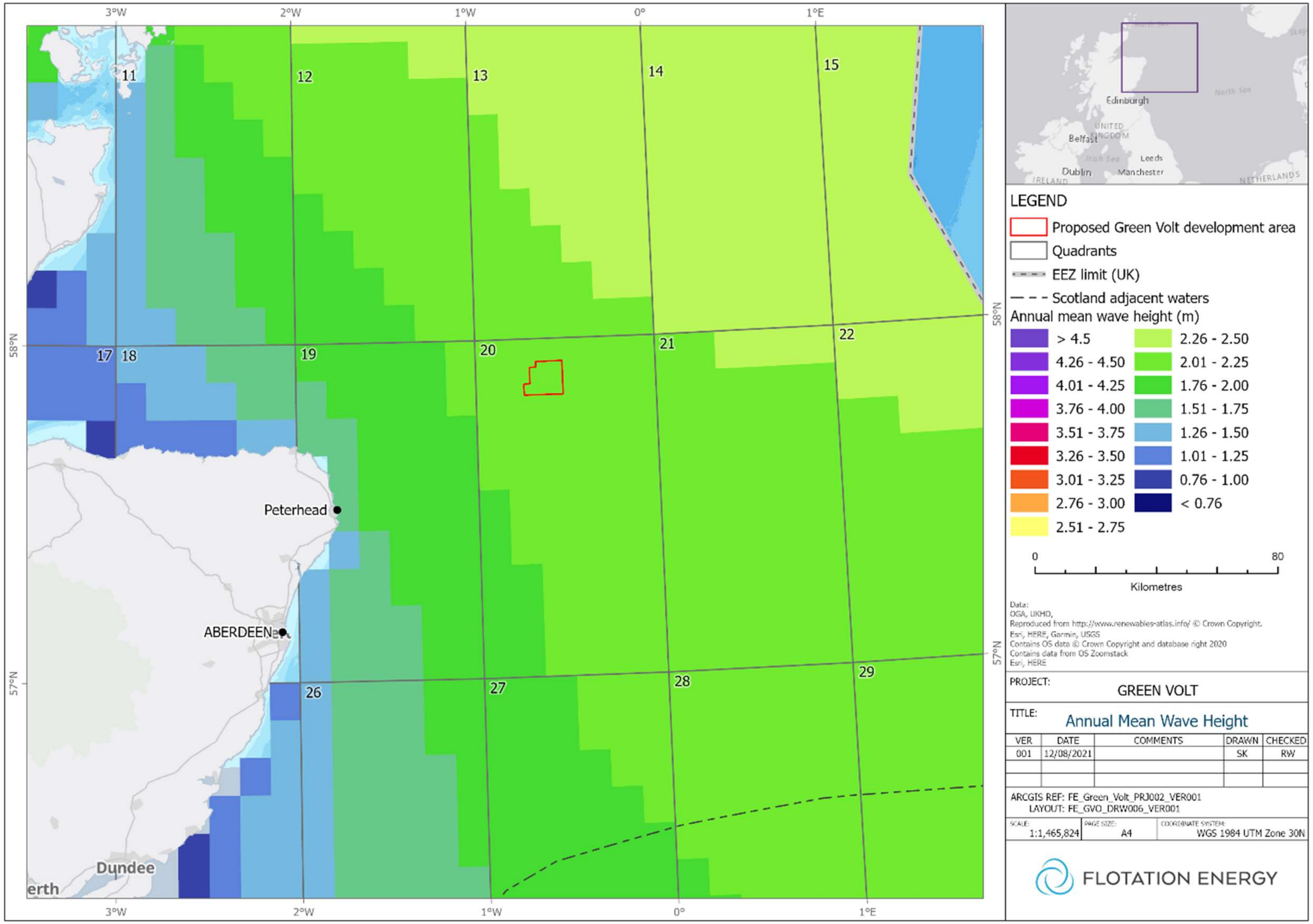


Figure 5.6 Directional all year significant wave height wave rose and occurrence (measured)

Measured wave data collected over several decades of oil and gas production have been used to calculate the extreme wave height (Hmax) and associated parameters and these will be used for initial design input for the turbines. These values are shown in Table 5.7. The one-year return period for wave height (Hs) is calculated to be 9.6 m, with the 100-year wave return period Hs being 12.7 m.

Table 5.7 Omni-directional extreme wave height and associated parameters (all year) ([16]).

Return Period (year)	Hs m	Hmax m	Range of Tz			Range of Tp			Range of Tass			Crest m
			s	s	s	s	s	s	s	s	s	
1	9.6	18.0	8.9	9.9	11.6	10.8	13.5	16.1	11.4	12.7	14.9	9.9
10	11.2	20.8	9.7	10.7	12.6	11.7	14.6	17.4	12.3	13.7	16.1	11.6
25	11.8	21.9	9.9	11.0	12.9	12.0	15.0	17.9	12.7	14.1	16.5	12.2
50	12.3	22.8	10.1	11.2	13.2	12.3	15.2	18.2	12.9	14.3	16.8	12.7
100	12.7	23.5	10.3	11.4	13.4	12.5	15.5	18.6	13.1	14.6	17.1	13.2
10,000	16.4	30.1	11.7	13.0	15.2	14.2	17.7	21.2	15.0	16.6	19.5	17.1

Table notes: Tass = wave period associated with maximum wave height; Tz = mean wave period (seconds); Hs = wave height; Tp = wave period.

5.3.2.2 Tides and Currents

Tides in this region flow from south to north and are semi-diurnal (there are two low waters and two high waters each day) and are relatively rectilinear (Figure 5.7 and Figure 5.8). Average tidal levels are shown in Table 5.8, with highest astronomical tide (HAT) and LAT noted at the top and bottom of the table. As expected, due to the distance offshore, the tidal range is limited in comparison to more inshore locations.

Tidal ellipses have been calculated for the Buzzard platform and for the Green Volt Project Area to the east. The ellipses show that the tidal currents run almost north-south with little east-west component, with the maximum axis speed calculated to be 42.0 cm/s with an orientation of 351.9º.

Associated current speeds and extreme tidal current surges are noted in Table 5.9 and Table 5.10. These current and tidal values are comparably low when compared to other floating offshore windfarms located closer to the coast, such as Kincardine offshore wind, and, therefore, the impact of tides and current velocities are known to be limited at the Windfarm Site. This has been confirmed by reviewing the 2021 full site multibeam survey data and seabed features produced by from previous oil and gas exploration and operation activities within the Ettrick and Blackbird oil field areas (pipelines and previous mooring patterns evident on the seabed). This shows that the oil and gas subsea infrastructure and older oil and gas wells dating back to the 1980's can still be clearly seen, with their associated sediment mounds around them on the 2021 multibeam surveys. This demonstrates that the tidal currents at this location are not sufficient strong enough to mobilise these new bed sediments, and this will be the same for the smaller subsea mooring systems, cables and substation jacket that will be installed on the windfarm site.

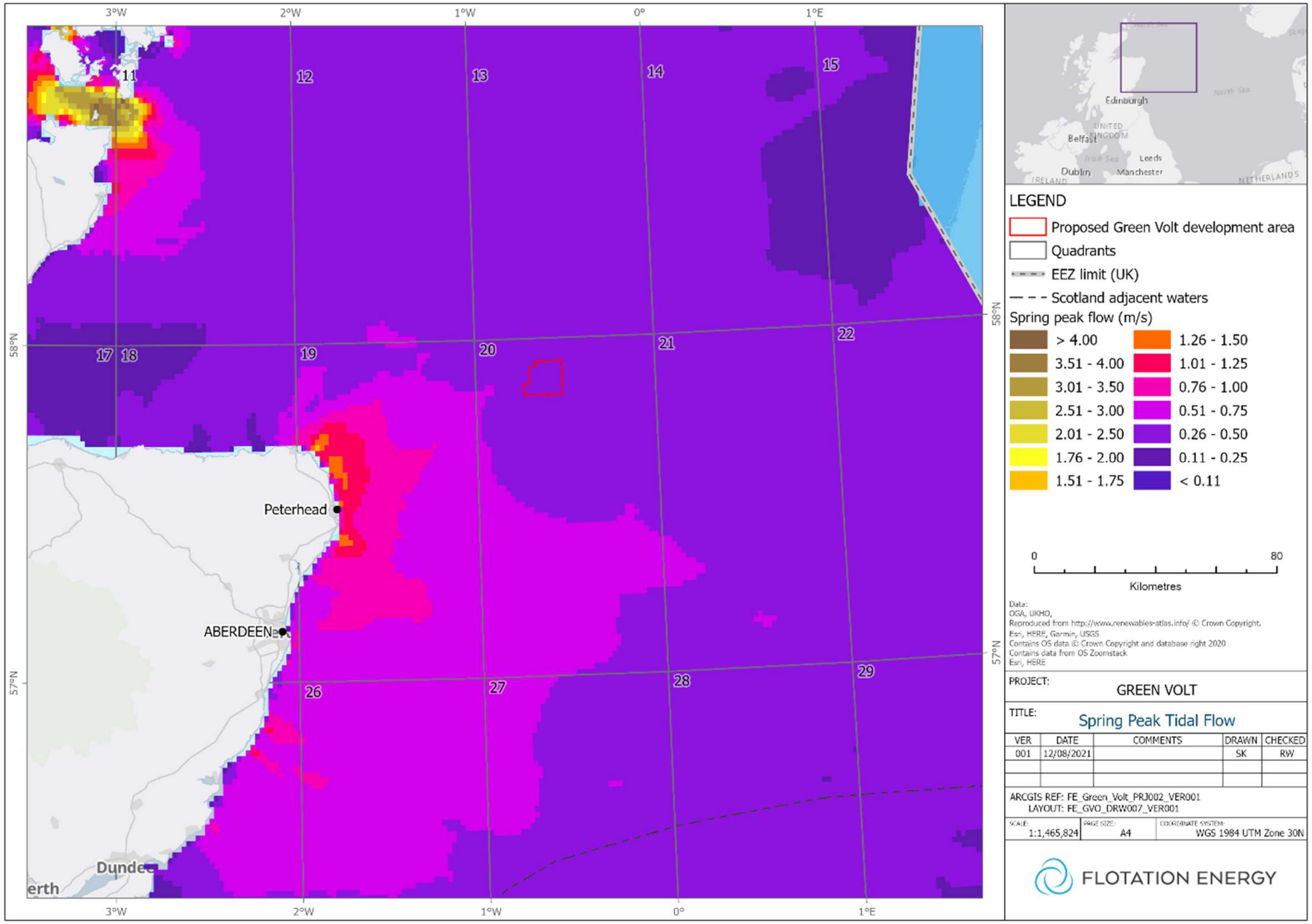


Figure 5.7 Spring peak tidal flow (m/s^{-1})

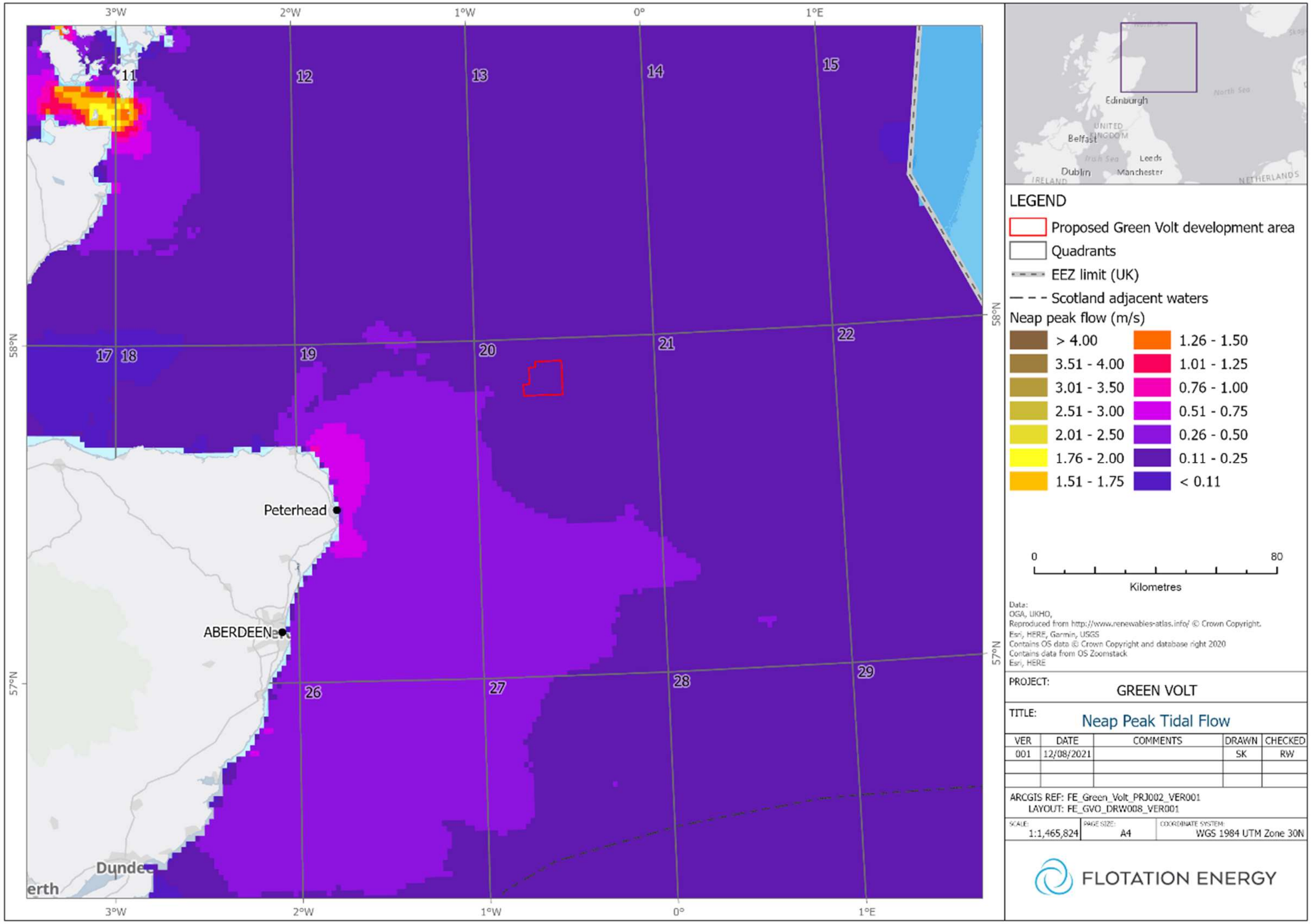


Figure 5.8 Neap peak tidal flow (m/s-1)

Table 5.8 Tidal levels (m) relative to LAT

Function	Water level (m)
HAT	3.26
MHWS	2.86
MHW	2.56
MHWN	2.25
MSL	1.69
MLWN	1.12
MLWS	0.47
LAT	0.00
M_2+S_2 Tidal Amplitude	1.16

Table 5.9: Omni-directional depth average surge current (m/s^{-1}) and 1m above sea bed

Return period	Surge current (m/s^{-1})	Extreme total current above seabed
1	0.42	0.19
10	0.53	0.22
25	0.58	0.23
50	0.62	0.24
100	0.66	0.25

Table 5.10: Extreme tidal surge levels (m)

Return period	Positive surge (m)	Negative surge (m)
1	0.74	-0.58
10	0.92	-0.69
25	0.99	-0.73
50	1.04	-0.75
100	1.09	-0.78

5.3.2.3 Wind

Mean annual wind speed in the North Sea increases with distance from shore out to about 40 km, after which the impact of the land is significantly reduced (Figure 5.9). For the Windfarm Site, the average annual wind speed is approximately 10.80 - 10.90 m/s (

Figure 5.10), which indicates average windfarm output values for this area will be significantly higher than the current inshore offshore windfarm sites located within Scotland and will produce higher operational hours for the turbines (Figure 5.11).

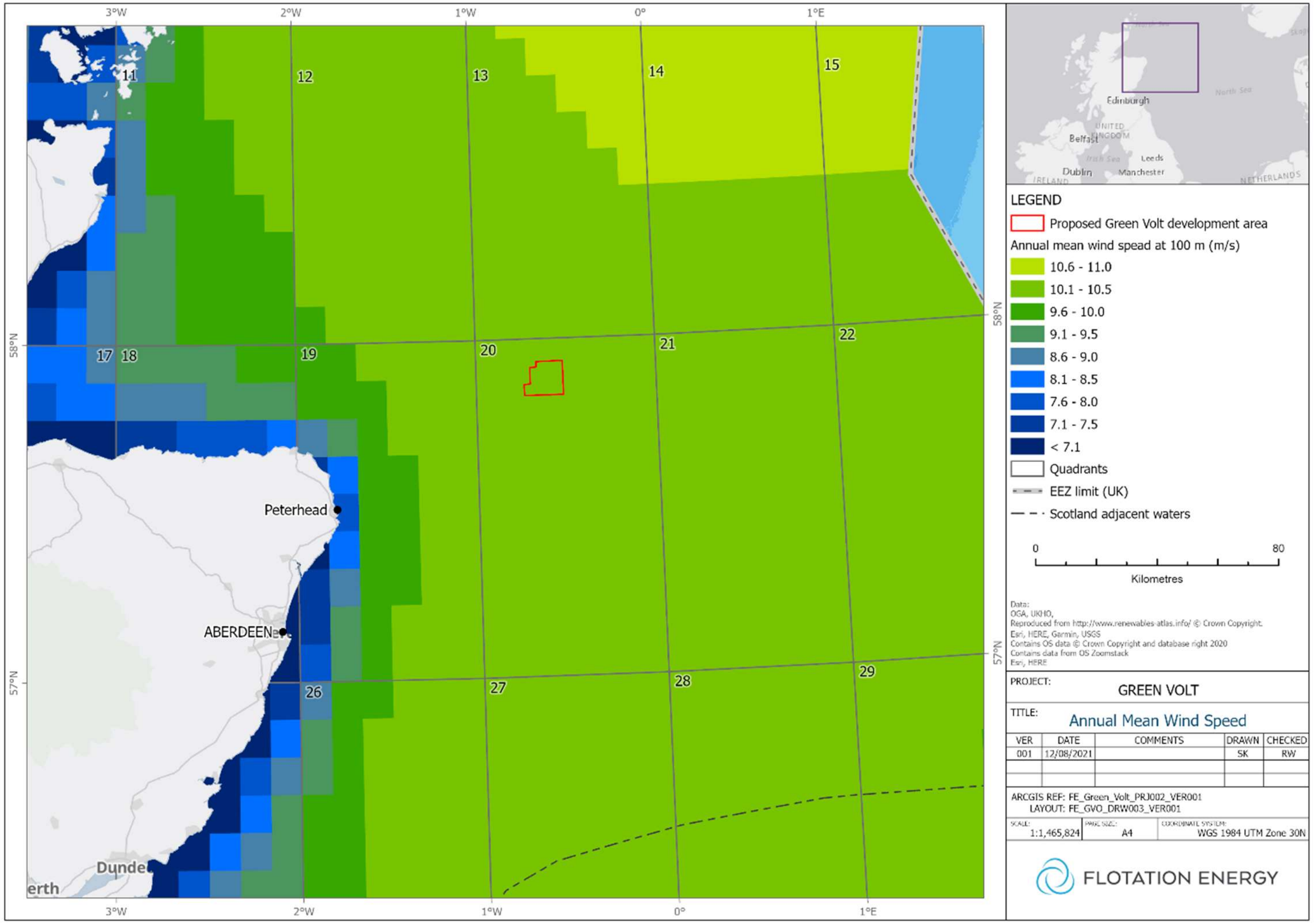


Figure 5.9 Annual mean wind speed (100 m above sea level)

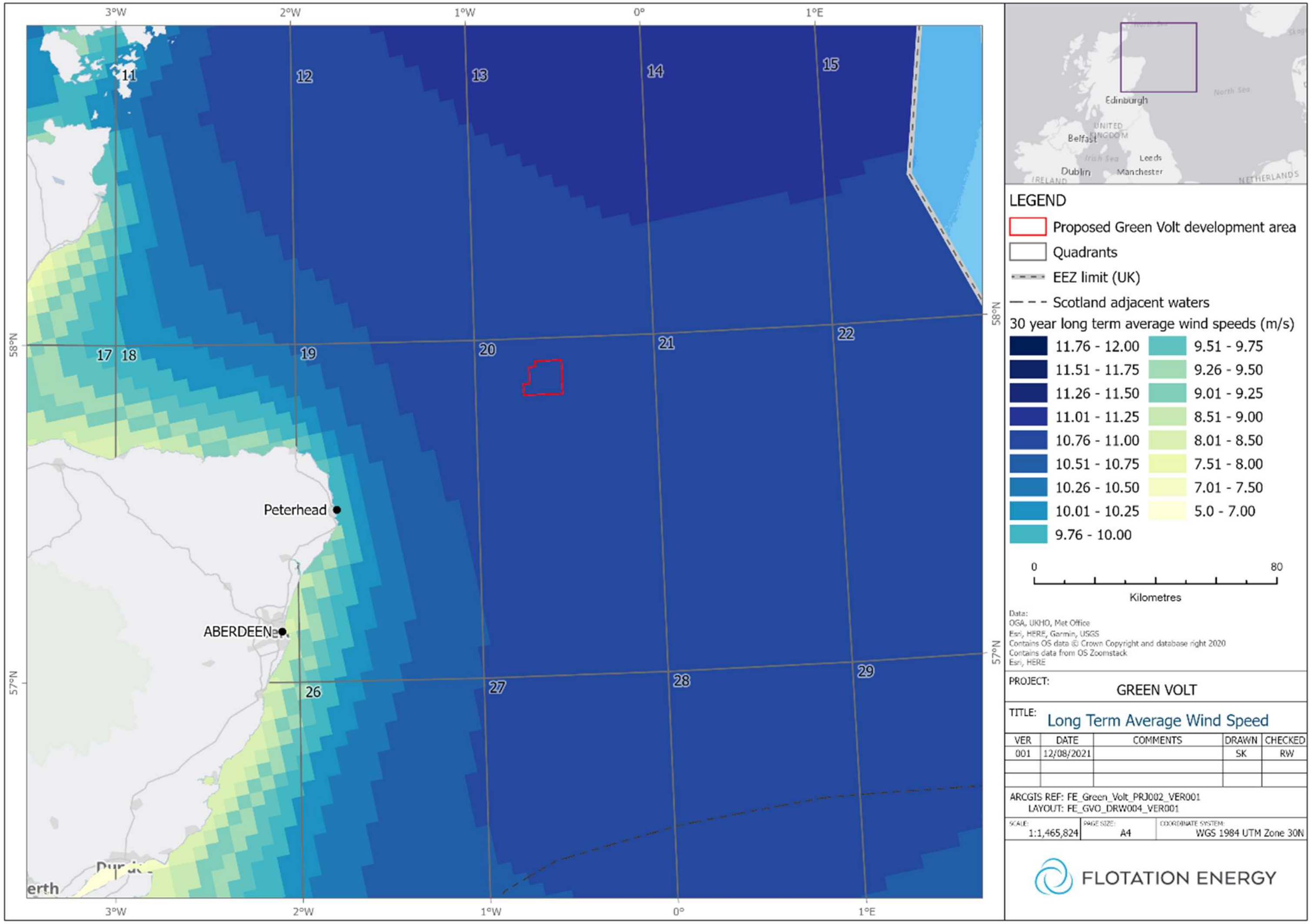


Figure 5.10 Annual mean wind speed (30-year average) (110 m above sea level)

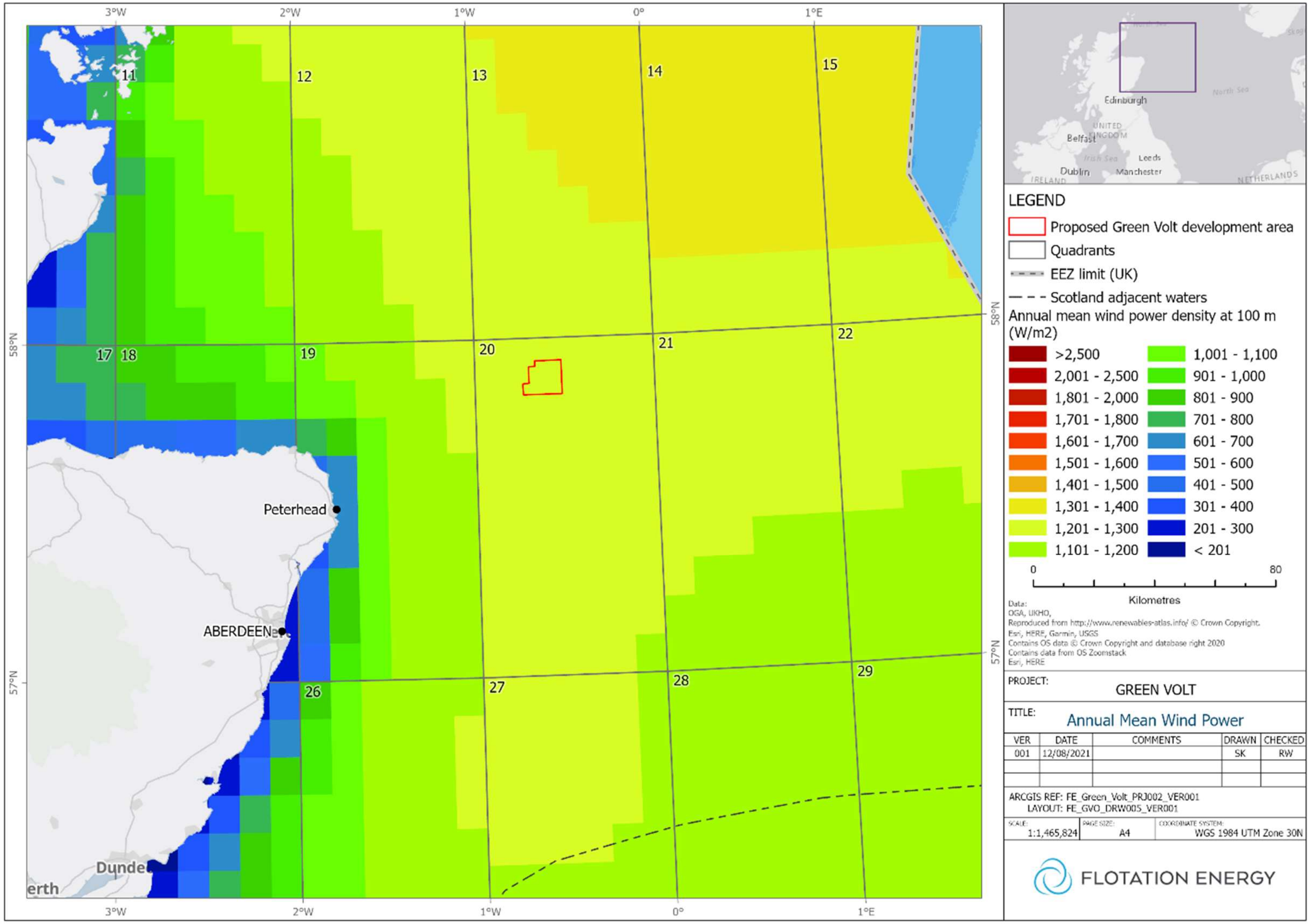


Figure 5.11 Annual mean power density at 100m

5.3.2.4 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

5.4 Water Quality

5.4.1 Data and Information Sources

The baseline data have been collected from the sources presented in Table 5.11.

Table 5.11 Baseline information – Water Quality

Type/description of data	Source	Status
Bathing waters and Scottish Water discharge locations	SEPA	Obtained
Water quality (clean and safe data) NMPI data	Marine Scotland NMPI database	Obtained

5.4.2 Existing Environment

There was no chemical analysis data available for the water at the Windfarm Site and export cable route from previous surveys; however, given the water mixing resulting from currents in the area, and the careful regulation of discharges from the oil and gas developments, it is anticipated the water quality at the Windfarm Site and along most of the export cable route will be typical of the central North Sea.

The two landfall options lie within the following waterbodies: Cairnbulg Point to the Ugie Estaury (to the north), and Buchan Ness to Cruden Bay (to the south). Both waterbodies have been classified as having High status under the Water Framework Directive (SEPA Water Classification Hub[3])

The closest bathing water beaches are located to the north of Peterhead (Cruden Bay). A long sea outfall (Scottish Water) is located to the south of Peterhead harbour and the water discharge location for the Peterhead power station. With both extending out approximately 300 m offshore (its installation geotechnical data is useful for near shore assessment of surface layer assessment and underlying hard rock geology). No known outfalls are known within the northern export cable landing locations (north of Peterhead).

5.4.2.1 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

5.4.3 Potential Impacts

The potential impacts relating to the potential changes to the water quality of the area during the construction, operation, and decommissioning phases are outlined below and summarised in Table 5.12.

Note that safety exclusion zones are in place around the old subsea wells heads and, therefore, these areas will not be subject to remobilisation of bed sediments due to interactions from the windfarm construction or operations.

[3] https://www.sepa.org.uk/data-visualisation/water-classification-hub/

Accidental spills and pollution events can occur from vessels and installation techniques required for the installation and operation of the windfarm.

Green Volt will commit to undertaking construction works in adherence will all relevant best practice guidance and legislation and will prepare all necessary plans in advance of construction activities. As such, it is considered that the impact of pollution due to leaks and spills from other vessels or other plant equipment can be scoped out of the assessment.

Table 5.12 Summary of potential impacts to water quality (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Pollution of the water through disturbance of the existing contaminated sediments (note that safety zones around old well heads will stop the remobilisation of these sediments in those areas)	✓	x	✓
Pollution of water from unplanned leaks and spills (WTG systems or vessels)	x	x	x

The effects of cable laying on sediment dynamics at the site will only impact during the act of cable laying and burial and will not result in a long-term bed form changes at site.

An assessment of the potential water quality and sediment disturbance will be undertaken as part of the EIA assessment in respect to the burial of the export cable and the seabed termination of the directional drill borehole. This will be in the form part of a desk-based assessment which will review the available onsite data and assess the impacts that such operations could have on the localised environment during the limit construction phase.

A review of the potential impacts on water quality from the development have identified no potential significant impacts, with limited impacts being associated with very localised suspension of sediments which is unlikely to have any extensive impact on the surrounding water column. In addition, the exclusion zones placed around the old well heads will further limit the resuspension of any potentially contaminated sediments into the water column. This will be addressed with the EIA report.

5.5 Sediment Quality

5.5.1 Data and Information Sources

Table 5.13 presents the sources of baseline data.

Table 5.13 Baseline information – sediment quality

Type/description of data	Source	Status
Existing sediment quality from Ettrick and Blackbird oil field surveys (2006-2021)	Ettrick and Blackbird oil field operators	Obtained
Existing sediment quality and disposal sites	Marine Scotland UKHO Bathymetric charts	Obtained

5.5.2 Existing Environment

5.5.2.1 Particle Size Distribution Analysis

Particle size analysis was performed using dry sieving techniques and laser diffraction at a number of locations across the Ettrick site and across a number of separate survey campaigns over a large number of years. Results for the 2006 survey are summarised in Table 5.14. A description of the sediment type of each sample is also given based on the Wentworth Classification (Buchanan, 1984), and B.S.5930 for descriptive terms. Additional survey data and results can be provided, and a full site decommissioning survey (undertaken by the operator) has been undertaken in 2021 and results will be reported in the 2022 and included in the EIA report for completeness.

Table 5.14 Summary of particle size of seabed at Ettrick site (2006)

Station	Depth (m)	Mean (µm)	Mean (Phi)	Sorting	Fines (%)	Sand (%)	Course (%)	Wentworth/B.S.5930 classification
1	112	0.1	3.2	1.2	14.8	85.2	0.0	Poorly sorted very fine SAND
3	111	0.1	3.4	1.3	17.8	82.1	0.0	Poorly sorted very fine SAND
5	115	0.1	3.2	1.2	2.8	87.1	0.0	Poorly sorted very fine SAND
6	114	0.1	3.3	1.5	18.7	81.2	0.1	Poorly sorted very fine SAND
7	114	0.1	3.8	1.4	21.7	78.3	0.0	Poorly sorted very fine SAND
8	114	0.1	3.3	1.2	17.1	82.8	0.0	Poorly sorted very fine SAND
9	111	0.1	3.4	1.3	17.3	82.7	0.0	Poorly sorted very fine SAND
10	111	0.1	3.2	1.2	14.7	85.1	0.1	Poorly sorted very fine SAND
11	111	0.1	3.2	1.3	15.3	84.7	0.0	Poorly sorted very fine SAND
12	111	0.1	3.2	1.3	16.0	84.0	0.0	Poorly sorted very fine SAND
13	95	0.2	2.2	0.9	5.9	93.6	0.5	Poorly sorted very fine SAND
Mean	111	0.1	3.2	1.2	15.7	84.3	0.1	Poorly sorted very fine SAND
SD	6	0.0	0.4	0.2	4.0	3.9	0.2	

The results from the 2006 survey show that the sediment distribution across the site was homogeneous, comprising poorly sorted, very fine SAND at 10 of the 11 stations and moderately sorted fine SAND at station 13, located in a shallower area to the north of the survey area. Mean phi at the majority of stations ranged from 3.2 (stations 1, 5, 10, 11 and 12) to 3.8 (station 7) and the sorting coefficient from 1.2 (stations 1, 5, 8 and 10) to 1.5 (station 6). Station 13 recorded a mean phi of 2.2 and a sorting coefficient of 0.9.

The proportion of sand at the majority of sample locations, excluding station 13, ranged from 78.3% to 87.1% (stations 7 and 5, respectively) and the proportion of fines ranged from 12.8% to 21.7% (stations 5 and 7 respectively). Sediments at station 13 comprised 93.6% sand and 5.9% fines. Coarse material was recorded at stations 6, 10 and 13 (0.1% to 0.5%).

5.5.2.2 Metals

A summary of results for the metal analyses is given in and presented in Table 5.15, Table 5.16 and Table 5.17 (NB: only metals showing a substantial variation between stations were plotted i.e. barium (Ba), chromium (Cr), iron (Fe), lead (Pb), vanadium (V), and zinc (Zn). All of the metals analysed (arsenic (As), Ba, cadmium (Cd), Cr, copper (Cu), mercury (Hg), aluminium (Al), nickel (Ni), Fe, Pb, V, and Zn) underwent a single hydrofluoric acid (HF) extraction, a total digestion of metals mineralised within the sediment. These results are presented in Table 5.15. Additional UKOOA 2001 average North Sea sediment contaminant concentrations values have been added in to provide context to onsite sediment values. All show that the onsite sediment values in 2006 are below the normal sediment contamination associated with North Sea oil platforms.

Table 5.15 Summary of metal analysis (μg.g⁻¹)

Station	ICOPES			ICPMS								
Heavy / Trace Metal	Ba	Al	Fe	As	Cd	Cr	Cu	Pb	Hg	Ni	V	Zn
North Sea average around oil and gas installation (UKOOA, 2001).	n/a	n/a	n/a	n/a	0.85	n/a	17.45	n/a	0.36	17.79	n/a	129.74
1	422	24,600	8,890	2	0.2	15	4	12	0.02	6	16	16
3	392	26,400	11,500	2	0.3	18	3	11	0.04	7	16	14
5	381	25,800	10,100	2	0.2	15	3	11	0.02	6	14	14
6	604	25,800	23,300	7	0.2	26	9	23	0.04	9	29	33
7	379	28,800	9,920	2	0.2	19	3	11	0.04	8	18	20
8	375	29,400	12,000	2	0.2	19	6	12	0.03	7	16	16
9	374	28,400	10,900	2	0.2	17	5	12	0.03	7	16	33
10	359	27,800	9,480	3	0.2	18	4	13	0.03	7	18	18
11	386	28,700	10,200	2	0.2	17	4	13	0.02	6	15	24
12	376	28,400	9,690	2	0.2	16	8	13	0.04	6	15	23
13	320	23,600	10,800	4	0.2	13	2	12	0.02	4	15	20
Mean	397	27,064	11,525	2.7	0.2	18	5	13	0.03	7	17	21
	73	1,923	4,008	1.6	0	3	2	3	0.01	1	4	7

Heavy and trace metal concentration distribution was relatively consistent across the site, with stations 6 and 13 generally recording the highest and lowest concentrations respectively.

The higher levels of certain heavy and trace metals, particularly arsenic, barium, chromium, copper, mercury, nickel, lead and zinc are consistent with potential contamination from the historic well 20/2-3. While this well was plugged and abandoned in 1983 (data from UK DEAL Database), it appears that higher levels of heavy and trace metals from drilling activities prior to 1983 have persisted in the surrounding sediments.

The most abundant heavy metal present in drill cuttings is barium, which is added to drill muds in the form of barite for density control. Barium can be toxic to some benthic species at elevated levels. Several other metals (Cd, Cu, Ni, Cr, Hg and Pb) are present in drilling muds as impurities of barite (OLF, 2003; Kennicutt *et al.,* 1996). Arsenic, silver, barium and zinc are also typically found in higher concentrations in drill cuttings.

The majority of heavy and trace metal concentrations were within the range of published UKOOA (2001) mean concentrations for the Central North Sea (where comparable data were available) and as such were considered to represent background levels for this sediment type in this region of the North Sea. The exceptions were barium, iron and lead which recorded concentrations above published values (UKOOA, 2001) at the majority of stations. This is consistent with the generally elevated levels of oil and gas exploration in this region, with at least seven wells located within Ettrick and Blackbird oil and gas field.

5.5.2.3 Total Organic Content

In conjunction to the particle size total organic content was assessed as part of the site survey. Total organic matter (TOM), measured by percent loss on ignition, is generally considered a coarse indication of sediment organics, quantifying not only the mass of organic matter but also carbonate (e.g., shell and shell fragments). For analysis of fractionated organic carbon (FOC), sediments undergo acid digestion to remove carbonate, prior to ignition. The resultant value provides a more accurate measure of the proportion of organic carbon and noted in Table 5.16. The proportion of organic carbon, both TOM and FOC, within the sediments was relatively constant across the site.

Table 5.16 Summary of organic carbon analysis (ug.g-1)

Station	Depth (m)	Fines (%)	TOM (&LOI)	FOC (%)
1	112	14.8	1.3	0.23
3	111	17.8	1.3	0.25
5	115	12.8	1.3	0.21
6	114	18.7	2.9	0.21
7	114	21.7	2.1	0.34
8	114	17.1	1.7	0.26
9	111	17.3	1.6	0.27
10	111	14.7	1.4	0.28
11	111	15.3	1.5	0.24
12	111	16.0	1.5	0.24
13	95	5.9	1.1	0.14
Mean	111	15.7	1.6	0.2
SD	6	4.0	0.5	0.0

5.5.2.4 Hydrocarbons

Hydrocarbon concentrations (total hydrocarbon concentrations, total n-alkanes and carbon preference index (CPI)) are summarised for each station in Table 5.17 and shown in Figure 5.4 (2006 survey). Extraction of hydrocarbons was undertaken on wet sediment samples. This technique is considered to extract a greater proportion of the target analytes than dry extraction methods; Wong & Williams (1980) estimated that around 16% of hydrocarbons determined by dry extraction procedures were lost as a consequence of the drying process. As such, comparison of recorded hydrocarbon levels with baseline concentrations from other surveys or published literature should be undertaken with caution. A sub-sample of the homogenised sample was dried to constant weight at 110°C, to provide a correction factor for wet / dry sediments

Table 5.17 Summary of hydrocarbon concentrations (µg.g-1 dry weight)

Station	Fines	THC	Alkanes (nC_{10-35})	UCM	CPI			Pristane	Phytane	Pristane/ Phytane
					(nC_{10-35})	(nC_{10-35})	(nC_{10-35})			
1	14.8	2.7	0.32	1.8	1.05	2.74	2.31	0.009	0.003	3.05
3	17.8	5	0.48	3.1	1.16	2.57	2.21	0.011	0.005	2.35
5	12.8	2.7	0.28	1.7	1.14	2.7	2.22	0.009	0.003	3.24
6	18.7	5	0.53	3.3	1.34	2.76	2.48	0.017	0.009	1.84
7	21.7	2.5	0.32	1.6	1.26	2.97	2.57	0.009	0.003	2.62
8	17.1	3	0.37	1.8	1.15	2.61	2.26	0.01	0.003	3.7
9	17.3	3.7	0.36	2.1	1.41	2.38	2.22	0.01	0.002	4.31

10	14.7	3.7	0.35	2.6	1.38	2.34	2.13	0.009	0.003	2.98
11	15.3	2.8	0.32	1.9	1.2	2.33	2.06	0.008	0.003	2.77
12	16.0	2.7	0.31	1.8	1.27	2.21	2	0.007	0.002	2.71
13	5.9	1.8	0.2	1	1.05	2.54	2.08	0.004	0.003	1.57
Mean	15.7	3.2	0.35	2.1	1.22	2.56	2.23	0.009	0.004	2.83
SD	4.0	1	0.09	0.7	0.12	0.23	0.17	0.003	0.002	0.78

5.5.2.5 Data Gaps

As part of the 2021 decommissioning site survey undertaken by the oil and gas field operators, resampling and additional sediment sampling has been undertaken across the entire development site and these sediments will undergo a full contaminant assessment (including PAHs) in line with current guidance. This information will be included within the EIA report for Green Volt Offshore Windfarm. These results will be compared to historic data to assess any changes to contamination levels in the seabed sediments over the 20 plus years of sampling at the site.

5.5.3 Potential Impacts

The potential impacts from the project during the construction, operation, and decommissioning phases are outlined below and summarised in Table 5.18. There are no known sediment quality issues associated with the Green Volt Project Area or within the identified export cable routes outside the safety exclusion zones around the old well head locations. Localised dredge disposal sites for the Port of Peterhead have been avoided in all export cable routing options.

Possible impacts relating to the potential changes to the sediment quality of the area are considered in Table 5.18.

Table 5.18 Summary of potential impacts to sediment quality (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Pollution of the sediment through disturbance of the existing contaminated sediments (potentially around old well heads, but areas excluded by safety zones)	✓	x	✓

The effects of cable laying on sediment dynamics at the site will only impact during the act of cable laying and burial and will not result in a long-term bed form changes at site which has the potential to remobilise bed sediment and associated contaminants into the water column to contribute to poor water quality. Therefore, there is not a significant issue in terms of sediment plumes and associated sediment water quality being generated from the site and the impact from the use of floating offshore platforms will have very limited impact, when compared to fixed structure windfarms, on the suspended sediment and water quality in the area surrounding the site. An assessment of the potential water quality and sediment disturbance will be undertaken for the burial of the export cable and the seabed termination of the directional drill borehole.

A review of the potential impacts on sediment quality from the Project have identified no potential significant impacts, with the limited impacts being associated with very localised scour issues that are unlikely to have any impact on the surrounding seabed within the Windfarm Site. The use of safety exclusion zones around plug and abandoned well heads will reduce the remobilisation of potential contaminated sediment at the Windfarm Site.

5.5.3.1 Proposed Additional Survey Requirements

As part of the geotechnical survey for the cable route, sediment cores will be obtained to inform the cable route assessment for the section from the edge. Surface sediment samples will be obtained for an appropriate number of grab samples and these will undergo a full contamination and sediment class assessment as outlined within the Marine (Scotland) Act 2013 in relation to sediment contaminants. This information will be used assess the potential inshore export cable area impact.

5.6 Air Quality

The following sections assess for the potential for effects of the project on air quality (vessel emissions) and the strategy to assess the impact of such effects.

5.6.1 Data and Information Sources

No site-specific surveys have been undertaken to inform this Offshore Scoping Report for air quality. This is because sufficient secondary data is available to support the decision of scoping out offshore air quality from the EIA.

Due to industrialisation of the coast and inshore area adjacent to the central North Sea there has been an increase in the levels of pollutants which decrease further offshore, though oil and gas platforms provide numerous point sources of atmospheric pollution (DECC, 2016).

The UK agreed to set emission ceilings through the National Emission Ceilings Directive (NECD), which was revised in 2016 (NECD 2016/2284/EU) to set emission reduction commitments for total emissions of NOx, SOx, non-methane volatile organic compounds (NMVOC), ammonia (NH3) and particulate matter (PM2.5) in 2020 and 2030. The UK has met these reduction targets for all of these pollutants for each year since 2010 inclusive with the exception for NOx for the year 2010 (NECD, 2020).

The Scottish Government suggest there have been long-term reductions in emissions for all pollutants due to various policies and strategies implemented within Scotland such as the CAFS – The Road to a Healthier Future (Scottish Government, 2015a and Scottish Government, 2020a), Climate Change (Emissions Reduction Targets) Act (2019) setting a 2045 target for Net Zero emissions (Climate Change (Emissions Reduction Targets) (Scotland) Act 2019), and establishment of Low Emission Zones (The Transport (Scotland) Act 2019).

5.6.2 Existing Environment

No current data is available for the air quality at the windfarm site due to the distance from shore. The onshore air quality will be assessed as part of the onshore EIA assessment process.

5.6.2.1 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

5.6.3 Potential Impacts

No potential significant impacts on air quality have been identified for this development due to the distance from shore (>75 km) and the distance to the nearest potential receptors (onshore), other than a small period of time when the cable lay vessel is close to the port of Peterhead (a source of significant local vessel emission) during the installation phase of the export cable. Additionally, due to the construction methodology for floating offshore wind, there is limited large vessel (for construction activities) activities on site activity during construction phase.

The potential for effects of the project on air quality and the strategy to assess the impact of such effects will be based on Table 5.19.

Table 5.19 Summary of potential impacts to air quality (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Emissions from vessels	x	x	x

During the construction and decommissioning phase, effects to air quality would be slight and temporary due to the location of the site and the relatively low amount of construction work offshore. During operation of the windfarm there would be no atmospheric emissions as a direct result of the energy generation. There will be some atmospheric emissions (such as sulphur dioxide (SO_2) and carbon dioxide (CO_2), oxides of nitrogen (NO_X) which represents the sum of nitrogen dioxide (NO_2) and nitrogen oxide (NO), and particulate matter (PM_{10} and $PM_{2.5}$)) associated with vessels used in the operational and maintenance period of the site as vessels will be used to transport staff to the platforms. However, the impact of this long-term use is still considered to be limited due to the very significant CO_2 removal this project creates by electrifying the Buzzard oil and gas platform and therefore air quality is not specifically assessed in the environmental statement.

5.7 Potential Cumulative Impacts

There is potential for the predicted impacts from the Development on physical processes to interact with impacts from other projects and activities in the physical processes study area and lead to a cumulative effect on receptors.

The cumulative assessment will consider the maximum adverse scenarios for each of the projects or activities across all phases of the Proposed Development. The following projects or activities will be considered within the physical processes study area:

- other offshore windfarms and associated cabling and infrastructure;
- oil and gas infrastructure/development (cables and pipelines); and
- other forms of cabling (i.e., telecommunications and interlinks).

5.8 Transboundary Impacts

No transboundary impacts have been identified as part of the physical processes review due to the low current speeds, distance from international boundaries and the very localised potential to transport mobilised material. The predicted impacts are only focused on the footprint of the Project Area.

5.9 Consultation

No formal consultation has been undertaken to date regarding physical processes. Following the receipt of the Scoping Opinion from MS-LOT, further consultation will be undertaken with MSS, NatureScot, SEPA, and the Moray Firth Regional Advisory Group (MFRAG) as required to ensure all potential impacts are considered appropriately and mitigated for as necessary.

6 The Biological Environment

This chapter was produced by Royal HaskoningDHV.

6.1 Benthic and Intertidal Ecology

This section describes the benthic and intertidal baseline environment and potential effects associated with the construction, operation and decommissioning of the Green Volt Project.

6.1.1 Data and Information Sources

Baseline data for the EIA will be reviewed from the sources provided within this section and detailed in Table 6.1. In addition, consultation with relevant stakeholders (see Section 4.3.1) will be carried out and considered as appropriate.

Table 6.1 Baseline Information – Benthic and Intertidal Ecology

Type / description of data	Source	Status
Site specific benthic data	Several site investigation survey reports commissioned by Nexen Petroleum UK Limited for the Ettrick and Blackbird sites, between 2005 – 2013.	Obtained
Nearby benthic data	Blackbird Field Development Environmental Statement (Nexen, 2010).	Obtained
Benthic and intertidal ecology data from cable route	NorthConnect EIA Report (NorthConnect, 2018)	Obtained
Marine Protected Areas	Marine Protected Area reports from NatureScot.	Obtained
Priority Marine Habitats	Priority marine habitats information from NatureScot and Joint Nature Conservation Committee (JNCC).	Obtained
North Sea benthic data	National Biodiversity Network (NBN) Atlas (https://nbnatlas.org/; accessed 10/09/2021).	Obtained
North Sea benthic data	UKSeamap 2010 Interactive Map (https://jncc.gov.uk/our-work/marine-habitat-data-product-ukseamap/; accessed 10/09/2021).	Obtained
North Sea habitats	European Marine Observation and Data Network (EMODnet) Seabed Habitats, data ranging from 2004 – 2014 (https://emodnet.ec.europa.eu/en/seabed-habitats; accessed 10/09/2021).	Obtained
North Sea benthic data	Marine Life Information Network (MarLIN) (https://www.marlin.ac.uk/; accessed 10/09/2021).	Obtained
North Sea habitats	NatureScot Habitat Map of Scotland (HabMoS) (https://www.environment.gov.scot/our-environment/habitats-and-species/habitat-map-of-scotland/; accessed 10/09/2021).	Obtained
North Sea benthic and intertidal habitats	MAGIC interactive map (https://magic.defra.gov.uk/; accessed 10/09/2021)	Obtained

6.1.1.1 Site-Specific Surveys

A site-specific survey was carried out between 20 August to 29 September 2021, which included, amongst others, sample collection for benthic habitat data. The survey covered the Project Area and the two export cable routes (one to Buzzard and the other to land). Sampling methods included grab samples and video transect surveys and stations using a remotely operated vehicle (ROV). The grab samples were analysed for physico-chemical substances and macrofaunal identification.

The aims of the environmental aspect of the survey were as follows:

- acquire environmental camera and seabed sample data to establish baseline environmental conditions;
- identify UKCS North Sea sensitive environmental habitats and species;
- provide a characterisation of the physical, chemical, and biological conditions of the area; and
- establish seabed conditions.

Out of the total sample locations surveyed, a number of these sample locations were situated on previous sample locations for surveys carried out for the Ettrick and Blackbird hydrocarbon fields. This will provide a good comparison for changes in benthic habitat between 2005 – present. The sample stations are presented in Figure 5.4. Initial survey results are presented in Section 6.1.2 (Gardline, 2021).

Once the export cable landfall location is determined, a Marine Intertidal Phase 1 Biotope Survey will be carried within the zone of influence (likely to be the extent of two tidal ellipses of length on either side of the approximate landfall site). Survey methods will follow those of Davies *et al.,* (2001) and Wyn *et al.,* (2006).

6.1.2 Existing Environment

The Green Volt Offshore Windfarm is located within the central North Sea. Biodiversity is generally lower in central and southern areas of the North Sea than in the northern areas (Künitzer *et al.,* 1992; Kröncke, 2011). The benthic species present within the area are largely correlated with the substrate type and associated hydrodynamic conditions and the following section provides information on the benthic species and habitats within the vicinity of the Project Area.

6.1.2.1 Subtidal Ecology

6.1.2.1.1 Windfarm Site

Desk Study

The seabed communities present at the Windfarm Site are typical of the wider areas of the North Sea at similar depths and sediment characteristics. The sediment type in the northern half of the Windfarm Site (Ettrick hydrocarbon field) consists primarily of fine silty sand with shell fragments (Fugro, 2011a; RPS, 2013; Calesurvey and BSL, 2013). To the north west of the Windfarm Site (within the Panda Bear site in UKCS Block 20/02), the area is dominated by megaripples and patches of shell debris (Fugro, 2011a). In the southern half of the Windfarm Site (Blackbird hydrocarbon field), survey data shows a homogenous slightly cohesive silty clay seabed with low proportions of sand observed in the grab samples. Epifaunal diversity in the Windfarm Site is general characterised as being low to moderate (Fugro, 2008; Fugro, 2011a; Fugro, 2011b; RPS, 2013; Calesurvey and BSL, 2013).

A survey was carried out by Calesurvey and BSL (2013), which included grab samples and drop-down video taken at a number of locations within the Ettrick area of the Windfarm Site (UKCS Block 20/2a and 20/3a) during October 2012. The survey recorded two main habitats: moderately bioturbated silty sand and isolated boulders with surrounding gravel, cobbles and shell fragments.

The moderately bioturbated silty sand (offshore circalittoral sand biotope SS.SSa.OSa; Conner *et al.*, 2004) was the predominant habitat across the survey area, with frequently observed species including the sea pen *Pennatula phosphorea* and polychaete tubes (Figure 6.1). Apart from these species, fauna was relatively sparse and included the following: hermit crabs (Paguridae), common starfish *Asterias rubens*, Norway lobster *Nephrops norvegicus*, spider crab, slender sea pen *Vigularia mirabilis*, polychaete casts, hydroid clusters, and tusk shells. These species were only occasionally recorded.

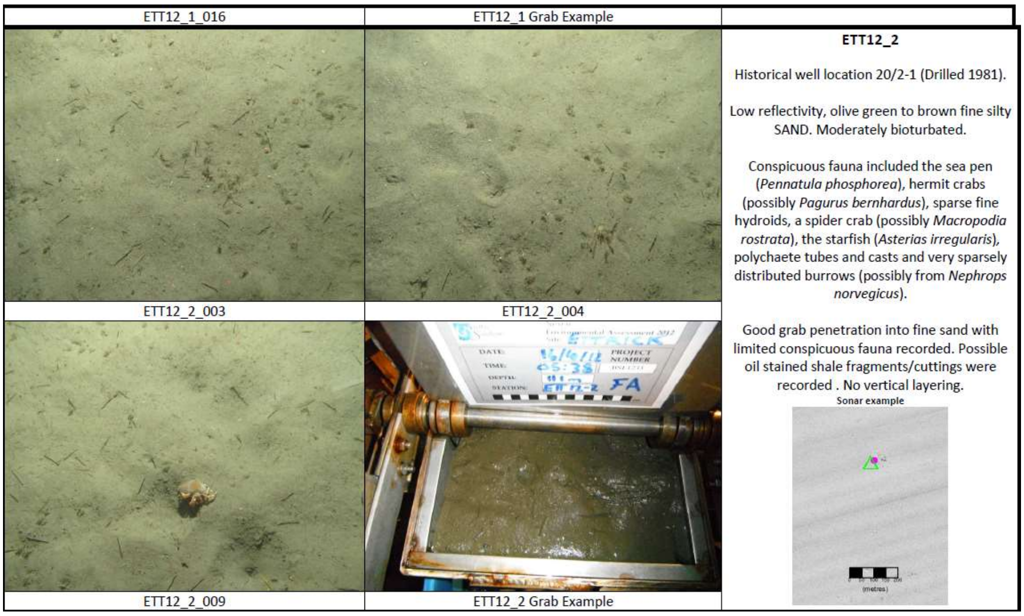


Figure 6.1 Sample survey pictures from one of the CaleSurvey & BSL (2013) sampling locations demonstrating the lack of fauna in the area.

The Calesurvey & BSL (2013) also recorded a number of boulders across the survey site, thought to be isolated features or associated with large pockmarks or depressions (Figure 6.1). It was unclear from the survey images whether the boulders were anthropogenic in nature or drop stones from the last glacial period. Visual analysis was limited due to poor visibility, making it difficult to identify any species; however, it was clear that, due to the size of some of the boulders, this was a cause of seabed turbulence as scoured gravels and shell material was recorded surrounding the feature to a distance of several metres (it is important to note that no scour has been observed around the existing subsea oil and gas installations; therefore, indicating that these features have been generated over a very long period of time). A high density of hydroids was associated with this habitat.

The biotopes associated with this area were classified as being more closely associated with offshore circalittoral mixed sediment biotope (SS.SMx. OMx) or a low energy circalittoral rock biotope (CR.LCR; Connor *et al.,* 2004).

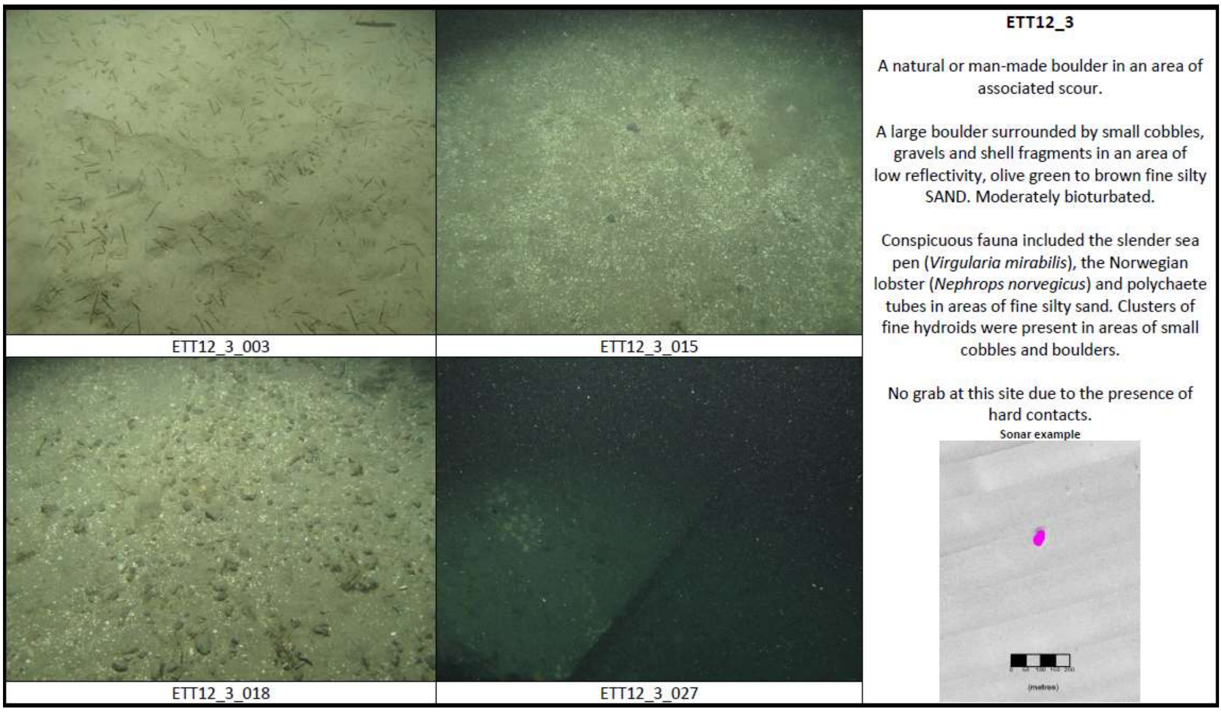


Figure 6.2 Sample survey pictures from one of the isolated boulders and associated scour in areas of pockmarks or depressions (CaleSurvey & BSL, 2013).

A survey was carried out by Fugro (2011b), which included a number of grab samples and drop-down video taken at a number of locations within the Blackbird area of the Windfarm Site (UKCS Block 20/02) during June – July 2011. Due to the homogenous nature of the sediments, the whole of the Blackbird survey area was classified as Circalittoral Muddy Sand biotope (SS.SSa.CMu.Sa; Connor *et al.,* 2004). This biotope is characterised by non-cohesive muddy sands, with sea pens and megafauna burrow communities sparsely distributed, but indicative of a muddy habitat in deep water (see Figure 6.2). The dominant species identified was polychaete worms, in particular the polychaete *Paramphinome jefferysii*, typical for this type of sediment (Nexen, 2010). *P. jefferysii* is an opportunistic colonising polychaete characteristic of deep, offshore, cohesive sandy muds. It is common throughout the North Sea in habitats similar to the Blackbird site.

An increase in fauna was observed in the pockmarks/depressions, which was also associated with an increase in coarse substrate and anthropogenic debris such as boulders, anchors, and rope. Sessile fauna such as cup corals, coral worms *Filograna implexa*, anemones, and hydroids colonised the boulders. Mobile epifauna included edible crab *Cancer pagurus*, hermit crabs, and spider crabs (see Figure 6.3).

These results are consistent with previous surveys carried out for the oil and gas industry (Fugro, 2011b). In general, the Windfarm Site is mainly characterised as being low in diversity, with epifauna sparsely distributed comprising mainly of seapens, hydroids, bryozoans, hermit crabs and Norway lobster (Nexen, 2010).

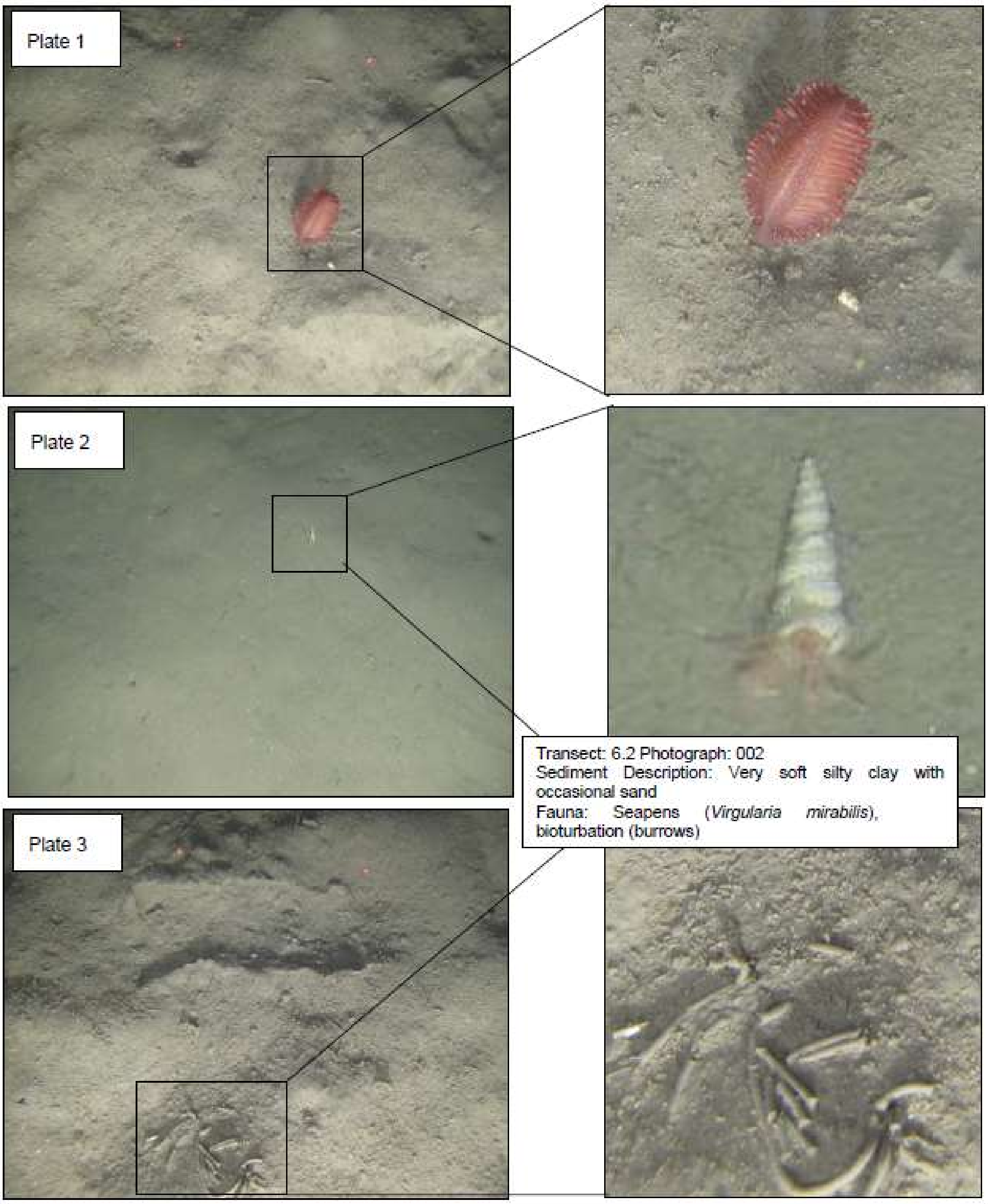
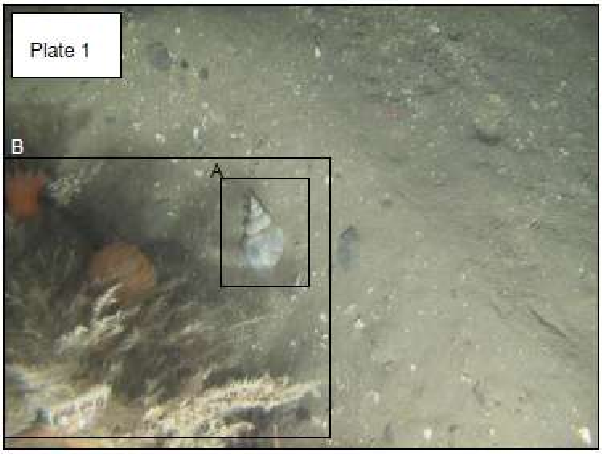


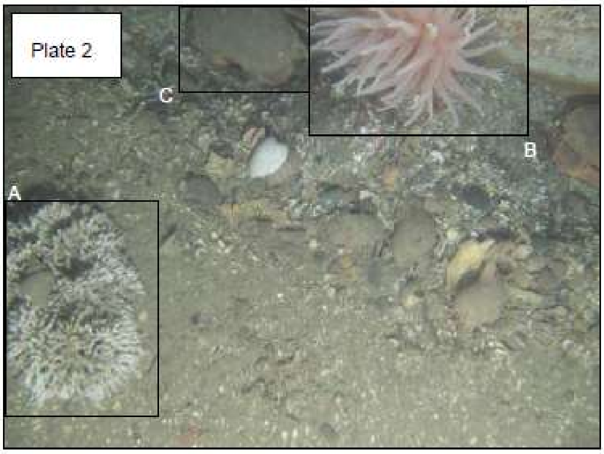
Plate 1: ENV 03 Photograph 7
Sediment: Silty sand — Fauna: Seapen (*Pennatula phosphorea*) (enlarged)

Plate 2: ENV 12a Photograph 12
Sediment: Silty Sand — Fauna: Hermit crab (Paguroidea) (enlarged)

Plate 3: ENV 05 Photograph 7
Sediment: Silty sand — Fauna: Tube worms and burrows (enlarged)

Figure 6.3 Sample survey pictures taken from the Blackbird survey showing the sediment and fauna present within the circalittoral muddy sand biotope (Fugro, 2011b).





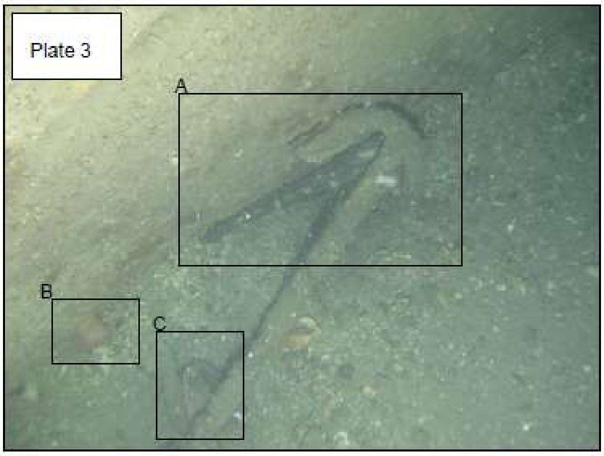


Plate 1: ENV 12b Photograph 14
Sediment: Silty sand and shell debris
Fauna: A: Whelk (Gastopoda)
B: Rope colonised by anemones (Actiniaria) and sea firs (Hydrozoa).

Plate 2: ENV 13b Photograph 10
Sediment: Silty sand with shell fragments and gravel
Fauna: A: Coral worm (*Filograna implexa*)
B: Anemone (Actiniaria)
C: Edible crab (*Cancer pagurus*)

Plate 3: ENV 13a Photograph 10
Sediment: Silty sand with large boulder and anchor. Gravel and shell fragment accumulation at base of boulder
Fauna: A: Unidentified fish (behind anchor)
B: Anemones (Actiniaria)
C: Edible crab (*Cancer pagurus*)

Figure 6.4 Sample survey pictures taken from the Blackbird survey showing the sediment and fauna associated with the coarse substrate patches found within the pockmarks/depressions (Fugro, 2011b).

Survey Results

Camera observations and geophysical data have characterised the Windfarm site as fine silty sand with occasional shell fragments. The soft sediment habitats were dominant at every location across the Windfarm Site, with the site overall appearing homogeneous. Bioturbated sediment featured across the site, with both large Nephrops burrows and smaller pencil burrows and faunal tracks (Figure 6.5).

Preliminary analysis of the footage suggests that ‘sea pen and burrowing megafauna communities’ habitat as defined by OSPAR (2010), were observed at all stations within the Windfarm Site.

These results are consistent with the previous surveys carried out between 2005 – 2013.

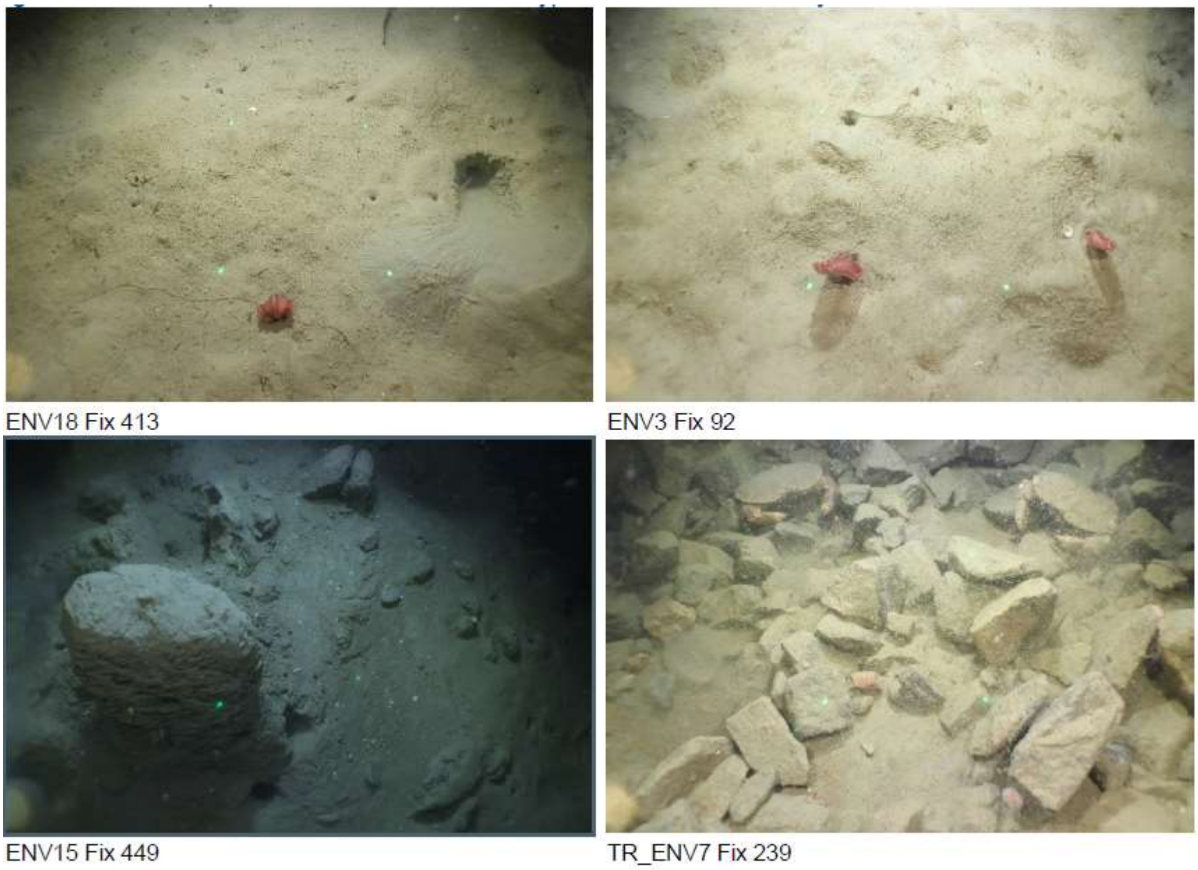


Figure 6.5: Examples of observed sediment types and habitats within the Windfarm Site from the survey results

The full list of species observed and identified in field sampling included:

- Annelida (*Oxydromus* sp., *Pectinariidae*, Polychaeta)
- Arthropoda (Brachyura, *Cancer pagurus*, Caridea, Decapoda, Euphausiacea, *Nephrops norvegicus,* Paguridae)
- Bryozoa (*Reteporella* sp.)
- Chordata (Actinopterygii, Gadidae, *Melanogrammus aeglefinus*, Myxiniformes, Perciformes, Pleuronectiformes, *Trichiuridae* sp., Triglidae)
- Cnidaria (Actiniaria, *Alcyonium digitatum*, Ceriantharidae Hydrozoa, Pennatulacea, *Virgularia* sp.)
- Echinodermata (Asteroidea, Echinoidea, Ophiuroidea)
- Mollusca (Bivalvia, Gastropoda, Octopoda, Sepiolida, Scaphopoda)
- Porifera

6.1.2.1.2 Export Cable Routes

6.1.2.1.2.1 Green Volt to Buzzard

Surveys carried out for the Panda Bear site (Fugro, 2011a), adjacent and to the west of the Windfarm Site, identified two biotopes that covered the Panda Bear survey site: Deep Circalittoral Sand (SS.SSa.Osa) and Deep Circalittoral Mixed Sediment (SS.SSa.OMx). This survey area is located just to the north of the proposed export cable route between the Windfarm Site and the Buzzard installation. Based on the other survey results from the UKCS Bock 20/02, it is highly likely that the benthic habitat within the proposed export cable route is similar to that recorded within the Panda Bear site survey.

The deep circalittoral sand occurred across the majority of the Panda Bear survey site, characterised by fine sands or non-cohesive muddy sands. Sea pens and burrowing megafauna communities were sparsely distributed across the biotope. Photography data from the Panda Bear survey indicate that deep circalittoral mixed sediment was associated with boulders found within potential pockmarks or depressions. This corresponds with the findings of the Ettrick survey above (CaleSurvey & BSL, 2013). This biotope is characterised by mixed sediments and poorly sorted mosaics of shell, cobbles, and pebbles on fine sand. Dominant species include the Devonshire cup coral *Caryophyllia smithii*, encrusting bryozoans and hydroids, along with hermit crabs and Norway lobster.

6.1.2.1.2.2 Green Volt to Onshore

Desk Study

The proposed offshore export cable route is planned to run alongside the NorthConnect (2018) cable route. Approximately 12 km offshore from Peterhead, the export cable route splits into two options: north of Peterhead, and south of Peterhead. The southern option also mirrors the NorthConnect consented cable corridor.

The sediment along the proposed offshore export cable corridor varies between sand, mud and mixed sediments with some gravel and boulders (NorthConnect, 2018). The majority of the export cable corridor is a mixture of circalittoral fine sand, circalittoral muddy sand, deep circalittoral sand and circalittoral sandy mud. The NorthConnect EIA Report (2018) also identified the following habitats (EUNIS classification; EEA, 2019) present that correspond to the location of the proposed Green Volt export cable corridor, although the NorthConnect consenting corridor was designed to exclude them due to their conservation value:

- A4.2211 - *Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock;
- A4.213 - *Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock (potential to support the Annex I habitat of bedrock reef or stony reef);
- A5.251 - *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (priority marine feature (PMF)); and
- A5.611 - *Sabellaria spinulosa* on stable circalittoral mixed sediment (although, at the time of survey, this was not classed as a reef).

The NorthConnect EIA Report (2018) also identified a number of pockmarks, corresponding to the more offshore part of the Green Volt export cable and overlapping with the Windfarm Site. None of the pockmarks appeared to have carbonate structures on them; therefore, they do not qualify as the Annex I habitat of 'submarine structures made by leaking gas'.

The *S. spinulosa* features identified during the NorthConnect (2018) surveys were identified up to approximately 5 km offshore from their proposed landfall point (south of Peterhead; Figure 6.6); which also corresponds to the proposed southern export cable landfall corridor for Green Volt. *S. spinulosa* reefs are biogenic reefs that are listed in Annex I of the EC Habitats Directive. The *S. spinulosa* reefs identified had the potential to quality as an Annex I reef; however, the NorthConnect cable corridor site selection process was designed to avoid these areas and, therefore, avoid potential impacts to these features. The site-specific survey undertaken in September 2021 also looked for evidence of *S. spinulosa* reefs.

Figure 6.6 Elevated aggregations of S. spinulosa tubes along the NorthConnect (2018) survey transect, approximately 5 km offshore from their proposed cable landfall

Survey Results

Camera observations and geophysical data characterised the sediments along the export cable route as predominantly rippled sand along the southwestern part of the route, becoming fine silty sand towards the north-eastern section joining the Windfarm Site.

Soft sediments were dominant along the export cable route, with the route overall comprising sandy sediments. Bioturbated sediment featured along the north-eastern section of the route, with both large *Nephrops* burrows, smaller pencil burrows and faunal tracks. Along the south-western section of the route the sediments transition to lightly rippled sand. Preliminary analysis of the footage suggests that ‘sea pen and burrowing megafauna communities’ habitat as defined by OSPAR (2010), were observed at all stations with the exception of two stations along the export cable route. The images shown in Figure 6.7 are examples of the type of habitats found along the export cable route.

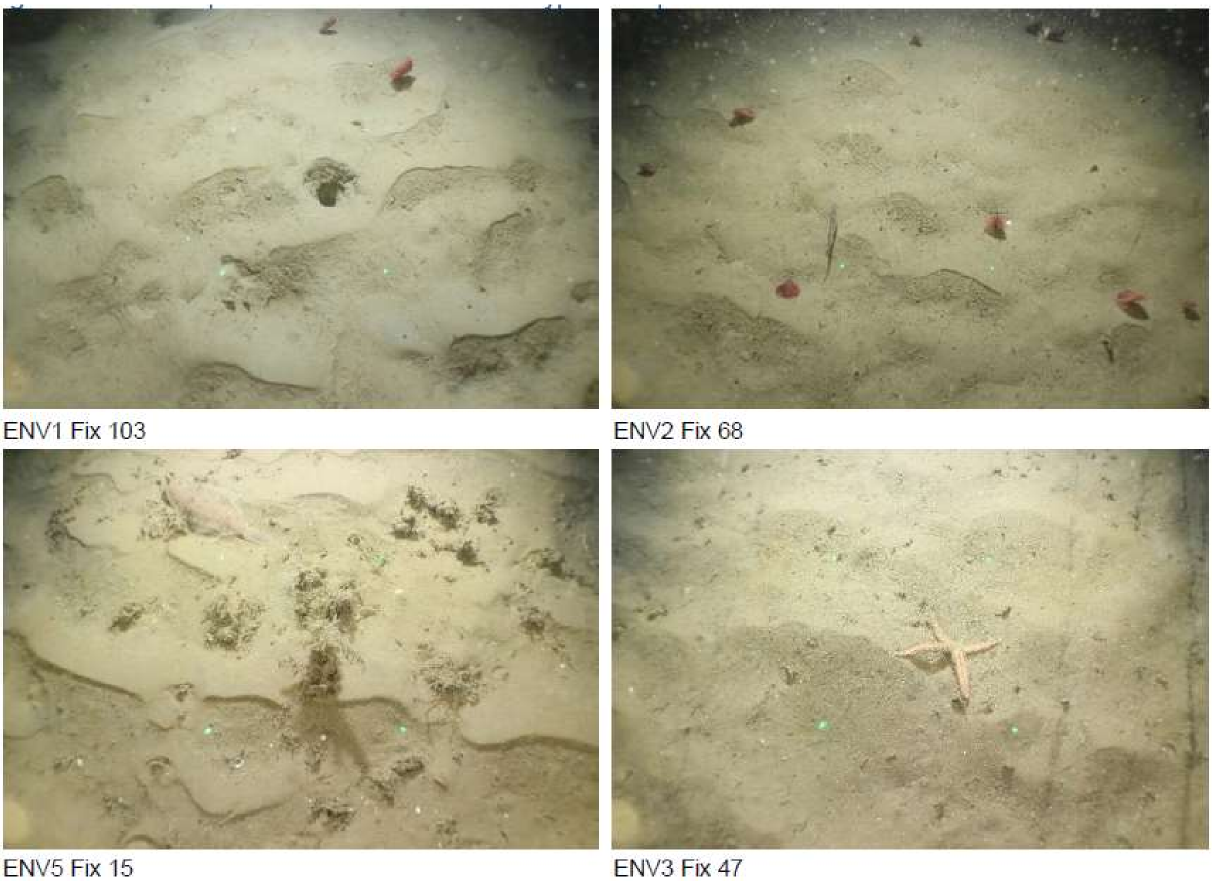


Figure 6.7: Examples of observed sediment types and habitats along the export cable route from the survey results

6.1.2.2 Intertidal Ecology

The landfall location has not yet been determined; however, there are two main areas currently under consideration:

- north of Peterhead, stretching from Peterhead to Rattray Head; and
- south of Peterhead, stretching from Peterhead to just north of the Bay of Cruden.

The coastline to the north of Peterhead comprises mainly of sandy beaches backed by an extensive sand dune community comprising of fixed dunes, shifting dunes, and unvegetated sand beaches above the driftline (NatureScot, 2012).

The coastline to the south of Peterhead is designated as the Buchan Ness to Collieston SAC, of which a part of the SAC overlaps with the proposed export cable corridor. Further details on the SAC can be found below. During the NorthConnect surveys, due to access issues, it was not possible to look at the intertidal section of the cliffs; however, the survey stated that it consists of cliffs which were observed to be an exposed, barren habitat, with populations likely limited to barnacles, limpets, chitons and other encrusting species present. There may also be some areas of fucoid algae, particularly in sheltered crevices (NorthConnect, 2018).

6.1.2.3 Protected Habitats/Species and Habitats/Species of Conservation Importance

6.1.2.3.1 Windfarm Site

The most likely protected habitats to be encountered in the Windfarm Site are as follows: 'Mud Habitats in Deep Water' priority habitat (JNCC & Defra, 2012), along with the similar OSPAR (2008) habitat of 'Seapens and burrowing megafauna communities', and the Annex I habitat 'Submarine structures made by leaking gases (including, inter alia, carbonates formed within pockmarks)'.

Survey carried out at the Panda Bear site (Fugro, 2011a), adjacent to the Windfarm Site, identified no carbonate mounds or structures produced from leaking gas (Annex I submarine structures made by leaking gas), even though pockmarks were identified. The CaleSurvey & BSL (2013) and Fugro (2011b) surveys also did not identify any Annex I submarine structures made by leaking gas.

No other surveys carried out between 2005 and 2013 yielded any evidence of Annex I habitats or biological communities of conservational significance (Gardline, 2009; Fugro, 2011a; Fugro, 2011b; CaleSurvey & BSL, 2013) at the Windfarm Site.

The Green Volt survey carried out in August/September 2021 identified species characteristic of the OSPAR (2010) habitat 'sea pen and burrowing megafauna communities' were observed at all the stations and transects selected at the Windfarm Site. Pennatulacea species were observed in imagery at all stations and transects within the windfarm site. No evidence of Annex I submarine structures made by leaking gas were observed during the survey. These results are consistent with the previous surveys carried out between 2005 – 2013.

6.1.2.3.2 Offshore Export Cable Route

The following protected habitats were recorded along the proposed export cable route:

- *Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock; and
- A5.251 - *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (PMF).

The protected habitats were identified during the EIA process carried out by NorthConnect (2018); the NorthConnect route was microsited to avoid the habitats. See sections above for further information.

6.1.2.4 Designated Sites

Designated sites under the Habitats and Birds Regulations[4] for benthic and intertidal habitats are Buchan Ness to Collieston SAC, Buchan Ness to Collieston Coast SPA. Information on qualifying interest features for which the SAC is designated, along with the supporting habitats for which the SPA is designated will be reviewed as part of the HRA screening.

Figure 6.8 shows the location of the SAC and SPA in relation to Green Volt Offshore windfarm.

---

[4] *The Conservation of Habitats and Species Regulations 2017 (as amended), and The Conservation of Habitats and Species Regulations 2010 (as amended).*

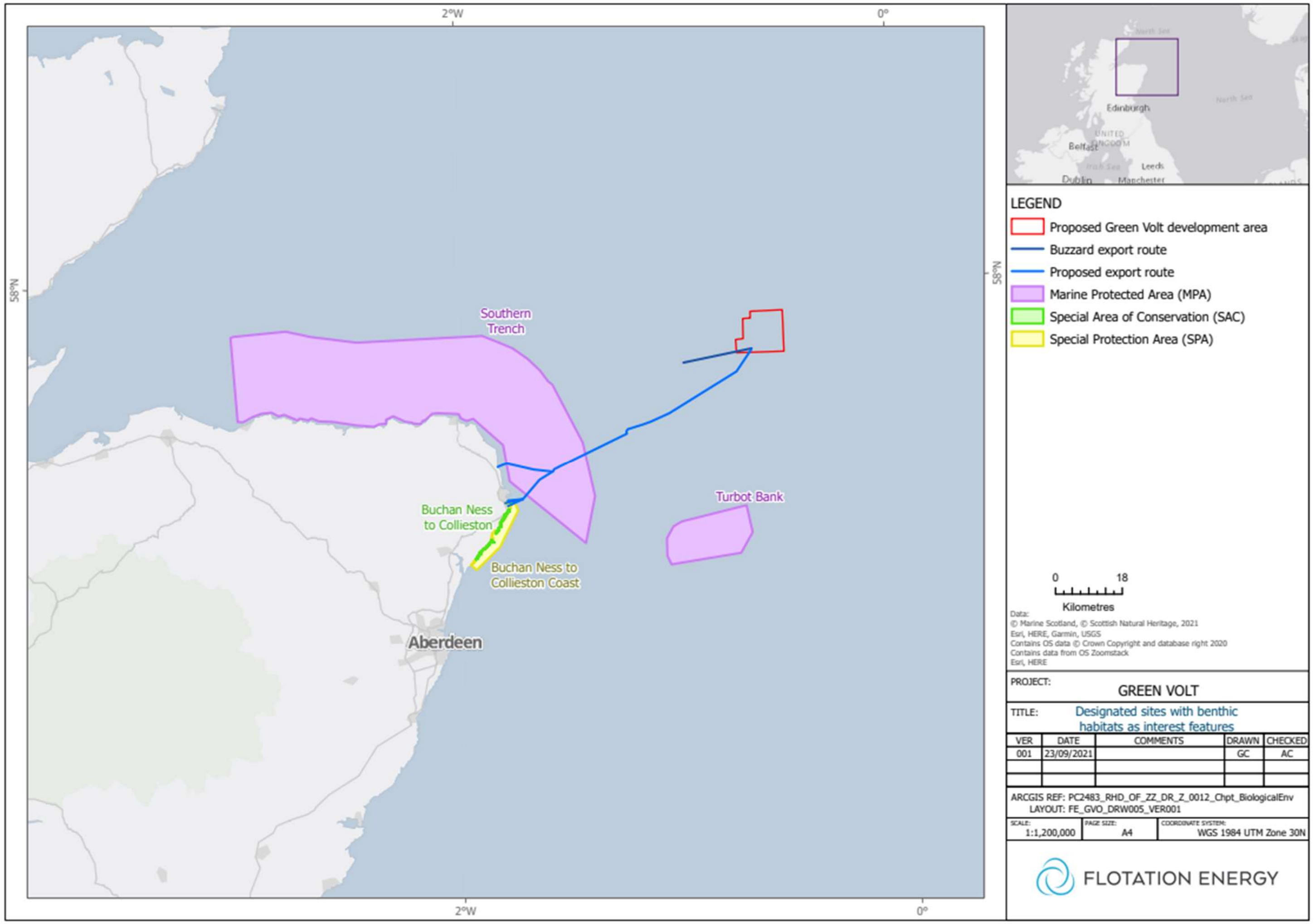


Figure 6.8 Designated sites with benthic habitats as interest features.

6.1.2.4.1 Buchan Ness to Collieston SAC

Buchan Ness to Collieston SAC overlaps with the proposed southern export cable corridor. The site is designated for 'Vegetated sea cliffs of the Atlantic and Baltic coasts'. The cliffs and slopes support a wide range of maritime habitats including grassland, crevice and ledge communities with characteristic species such as thrift *Armeria maritima*, Scots lovage *Ligusticum scoticum* and roseroot *Sedum rosea*. The cliff top has some of the best examples of heath and brackish flushes on the coast of north-east Scotland. The SAC designation does not provide information on the intertidal species of the cliffs.

6.1.2.4.2 Buchan Ness to Collieston Coast SPA

Buchan Ness to Collieston Coast SPA overlaps with the proposed southern export cable corridor. The cliffs at the SAC/SPA support a number of internationally important bird species including fulmar *Fulmarus glacilalis*, guillemot *Uria aalge*, herring gull *Larus argentatus*, kittiwake *Rissa tridactla*, shag *Phalacrocorax aristotelis*, and seabird assemblage.

For the purposes of this chapter, it is the habitats supporting the bird species that is being assessed, rather than the birds features themselves. Birds are considered in Section 6.4.

6.1.2.4.3 Marine Protected Areas

There are two Marine Protected Areas (MPA) designated for benthic habitats that may be affected by the proposed development. These are the Southern Trench Marine Protected Area (STMPA) and Turbot Bank.

6.1.2.4.3.1 Southern Trench Nature Conservation Marine Protected Area

The STMPA is located on the east coast of Scotland in the outer Moray Firth and is designated to protect marine mammals (minke whales), burrowed mud, fronts and shelf deeps. The offshore export cable corridor passes through the MPA (see Figure 6.8).

The STMPA is a 58 km long, 9 km wide, and 250 m deep trench that runs parallel to the coastline. The MPA features a dynamic mixing zone of warm and cold waters that attracts shoals of herring, mackerel and cod to the area, with the soft sands providing abundant habitat for sandeels. These, in turn, provide food for migratory mammals, such as minke whales, to the area (NatureScot, 2020). Figure 6.9 provides the location of the STMPA and the distribution of its protected features.

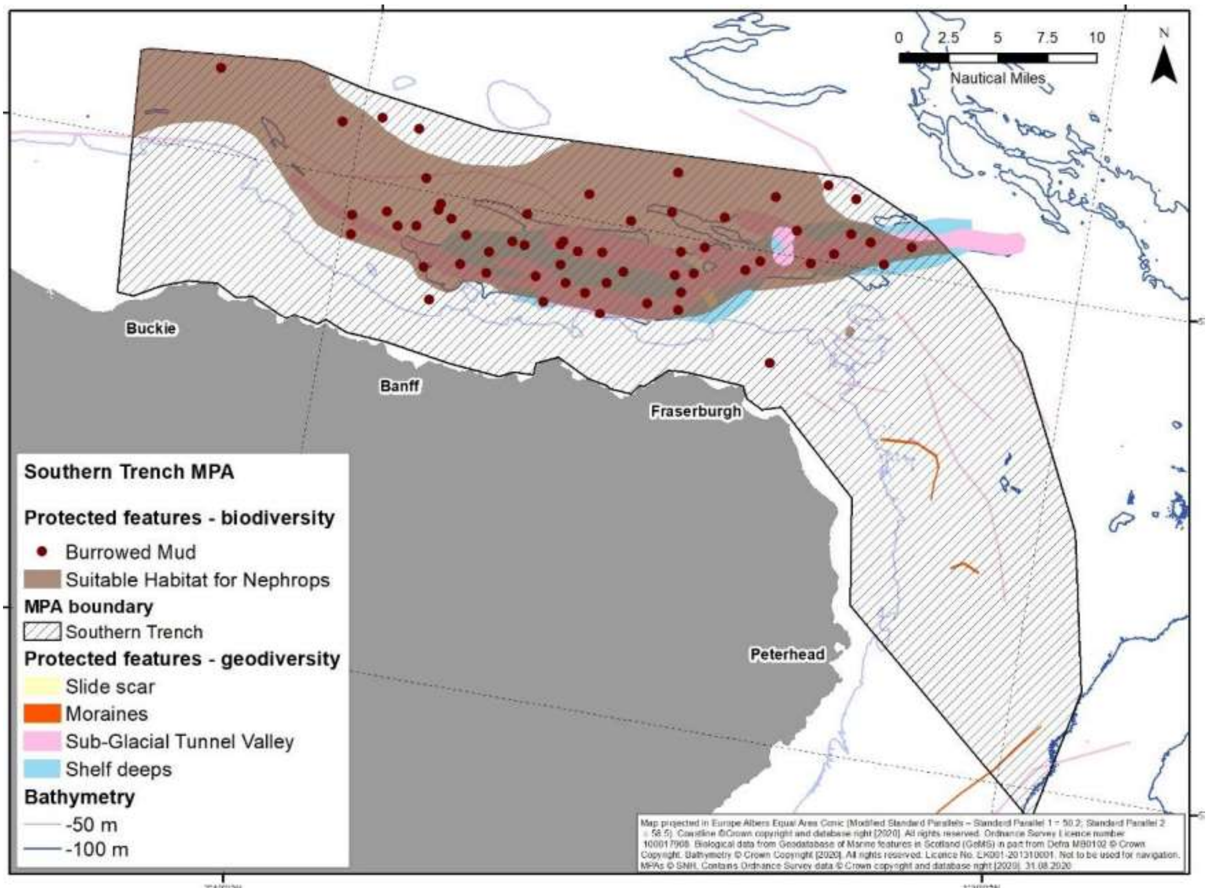


Figure 6.9 Location of the Southern Trench MPA and distribution of its protected features (NatureScot, 2020).

The seabed burrowed mud habitat (SS.Smu.CFiMu.SpnMeg) present in the MPA is characterised by the presence of Norway lobster, crabs, seapens, and anemones.

The burrowed mud feature is in favourable condition but is listed as 'Threatened and/or Declining' under OSPAR (2008). Burrowed mud habitats are highly sensitive to physical disturbance, including abrasion/removal of seabed, as well as disturbances leading to water flow, wave exposure, and siltation alterations. The burrowing megafauna characteristic of burrowed mud communities are important bioturbators of the sediment they inhabit. This activity creates a three-dimensional structure of burrows which increases the structural complexity and depth of oxygen penetration into the sediments. This enhances the survival of smaller species which can live in the burrows and increases biodiversity in what would otherwise be a generally low diversity habitat (NatureScot, 2020).

The conservation objectives of the site are to conserve the extent and functions of the habitat, including to: "*Conserve the diversity, abundance and distribution of typical species associated within the burrowed mud (including Nephrops norvegicus, Pennatula phosphorea, Virgularia mirabilis, Goneplax rhomboides, Munida sp., Calocaris macandreae, Callianassa subterranea)*."

6.1.2.4.3.2 Turbot Bank Nature Conservation Marine Protected Area

Turbot Bank MPA is located off the east coast of Scotland, approximately 40 km to the south west of the Windfarm Site, and 25 km to the south of the proposed export cable route (see Figure 6.8). Turbot Bank is designated for the protection of sandeels, particularly Raitt's sand eel *Ammodytes marinus*, which provide a vital food source for larger fish, seabirds, and marine mammals.

The Conservation Objective for the MPA is (JNCC, 2018):

- so far as already in favourable condition, remain in such condition; and
- so far as not already in favourable condition, be brought into such condition, and remain in such condition.

Specifically:

"*With respect to the Sandeels, this means that the quality and quantity of its habitat and the composition of its population are such that they ensure that the population is maintained in numbers which enable it to thrive.*

Any temporary reduction of numbers is to be disregarded if the population of Sandeels is thriving and sufficiently resilient to enable its recovery from such reduction. Any alteration to that feature brought about entirely by natural processes is to be disregarded."

6.1.2.5 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

6.1.3 Potential Impacts

The potential impacts from the Green Volt Offshore windfarm during the construction, operation, and decommissioning phases are outlined below and summarised in Table 6.2. Sensitivities of the benthic and intertidal habitats and communities will be judged for each of these phases on the basis of expert judgement and reference to Marine Evidence-Based Sensitivity Assessments (MarESA) available on the Marine Life Information Network (MarLIN) websitE.

In addition, the potential for cumulative and transboundary impacts, as well as inter-relationships and interactions between impacts for the Project Area will also be determined and assessed.

6.1.3.1 Potential Impacts During Construction

The potential impacts on benthic and intertidal ecology from activities carried out during the construction phase that are scoped in for further assessment in the EIA are:

- Physical disturbance and temporary habitat loss of seabed habitat
- Physical disturbance and temporary habitat loss of intertidal habitat
- Increased suspended sediments and sediment re-deposition
- Re-mobilisation of contaminated sediment during intrusive works
- Potential impacts on the STMPA

The potential impacts on benthic and intertidal ecology from activities carried out during the construction phase that are scoped out for further assessment in the EIA are:

- Potential impacts on Turbot Bank MPA
- Potential impacts on Buchan Ness to Collieston Coast SAC/SPA
- Accidental spills and pollution events

6.1.3.1.1 Physical Disturbance and Temporary Habitat Loss of Seabed Habitat

Certain habitats recorded within, or near the vicinity of the Development are known to be sensitive to physical disturbance, e.g. *S. spinulosa* reefs and habitats supporting sea pens.

There is the potential for direct physical disturbance of the seabed and temporary habitat loss caused during the installation of the inter-array and export cables and foundation installation of the substation jacket structure. Disturbance caused by the installation of the cables includes seabed preparation (trench cutting) and cable laying with backfill as required. Disturbance caused by substation installation include the use of a jack-up vessel and mud mats used as stab guides for piling. Areas affected by jack-up operations and cable installation will be relatively small and seabed recovery is expected quickly following cessation of installation activities, given the likely tolerance and recoverability of the communities present.

Floating offshore wind mooring systems likely to be installed at the Windfarm Site (catenary mooring) will likely protect the seabed around each structure for the lifetime of the Windfarm (expected to be 50-60 years) from other destructive seabed activities and this may actively promote the long term recovery of the seabed beneath the development site.

6.1.3.1.2 Physical Disturbance and Temporary Habitat Loss of Intertidal Habitat

HDD is the preferred method for the installation of the export cable across the intertidal zone. However, this method of installation is not guaranteed, and open trenching of cables may be considered, depending on the location of cable landfall and where HDD is impractical due to technical and/or engineering constraints.

For the northern landfall option, the likelihood of using open trenching increases; therefore, if this option is adopted, impacts on intertidal habitats are scoped in. For the southern landfall option, however, it is highly likely that HDD will be used to install the export cable. If this method is adopted, then impacts on intertidal habitats can be scoped out.

6.1.3.1.3 Increased Suspended Sediments and Sediment Re-Deposition

Construction activities have the potential to cause mobilisation of sediments in the water column and an increase in suspended sediment concentrations (SSC). Such concentrations have the potential to affect benthos through blockage of filter feeders and/or smothering sessile species. However, given the substrate at the site, the low current velocity at the development site to transport material, it is likely that the communities are habituated to smothering from natural events and, therefore, have some tolerance. Evidence suggests that this is the case given the dominant species and communities detailed above.

The magnitude of the potential impact will be based upon the outcomes of Section 5.5. The magnitude of the effect of sediment smothering on benthic receptors will be considered in terms of a worst-case scenario (i.e. maximum area impacted, the maximum duration of smothering and the maximum thickness of deposited material).

Sensitivities will be informed by available literature including the assessments available on MarLIN and peer-review publications.

Impacts will be assessed in relation to background SSC levels and natural variations arising from storm events and seasonal changes. The nature, type and duration of potential construction and operational activities will be considered to determine the magnitude of impacts.

6.1.3.1.4 Re-mobilisation of Contaminated Sediment During Intrusive Works

Sediment disturbance could lead to the mobilisation of contaminants (if present) that could be harmful to benthic communities. As the Windfarm Project Site is within the footprint of previous oil and gas activity, there is the potential for contaminants being adsorbed and contained within sediments, which may be released following disturbance. Potential contaminants include the discharge of chemicals under the OSPAR harmonised mandatory control system (HMCS), and other contaminants such as drill cuttings, flare drop out, etc.

Analysis of sediment chemistry as part of the Ettrick and Blackbird decommissioning programme recorded that overall, TOM, total organic carbon (TOC), polycyclic aromatic hydrocarbons (PAH), alkanes and barium values to generally be within typical background levels for the North Sea, indicating that the background organics were predominately from a natural biogenic origin as opposed to anthropogenic sources, e.g. drill cuttings, flare drop out, etc, apart from at one well location where point source petrogenic contamination was apparent. The levels of barium, alkanes, mercury, iron, lead and zinc were found to be above background levels in the sample taken close to the well, with these elevated levels being attributed to historical drilling contaminants (Genesis, 2016). Bottom currents are known to be low in the footprint of the Development Area (see Section 5); therefore, re-mobilised contaminants are unlikely to travel far from their original location and the footprint of contamination is likely to be localised and small for each disturbance event.

Safety exclusions zones will operate around the well head locations across the development site, which will likely represent the areas of highest potential seabed contamination due to the drill arising. These safety zones (to protect the plugged and abandoned well heads) will ensure that no Green Volt infrastructure will disturb these zones and, therefore, the potential to remobilise the bed sediments in these zones is significantly reduced.

The magnitude of the potential impact will be based upon the outcomes of Section 5. The magnitude of the effect on benthic receptors will be informed by site specific contaminant data. The nature, type and duration of potential construction activities will be considered to determine the magnitude of impacts.

Sensitivities will be informed by available literature including the assessments available on MarLIN and peer-review publications. Impacts will be assessed in relation to background contaminant levels.

6.1.3.1.5 Potential Impacts on Designated Sites

The provisional offshore export cable corridor runs through the STMPA and is in the vicinity of the Turbot Bank MPA. Also, depending on the landfall option chosen, there is the possibility of the export cable crossing through the Buchan Ness to Collieston Coast SAC and SPA.

Secondary impacts on benthic habitats extends to an approximate distance of two tidal ellipses from the source, to ensure that all potential secondary impacts are captured. From Section 5, the extent of two tidal ellipses is a maximum of 20 km in a north west to a south east direction. As Turbot Bank MPA is over 25 km distance from the proposed cable corridor, and over 40 km distance from the Windfarm Site, it is highly unlikely that there will be secondary impacts from construction activities to the MPA. Therefore, Turbot Bank MPA is scoped out of the EIA.

As the cable corridor for both landfall options runs through the STMPA, it is not possible to scope out any impacts from the installation of the export cable to the burrowed mud habitat of the STMPA.

If the southern export cable landfall option is chosen, there is the potential for the installation of the cable to adversely affect the qualifying interest features of the SAC and supporting habitats of the SPA. As the SAC/SPA consist of vegetated cliffs, it is highly likely that HDD construction method will be used for cable installation should the chosen landfall be within the footprint of the SAC. As HDD will commence outside of the SAC/SPA and route through and under the SAC/SPA, no impacts on the qualifying features of the site are anticipated. Therefore, Buchan Ness to Collieston Coast SAC/SPA is scoped out of the EIA.

See the HRA Screening Report for further information on the SAC and SPA.

6.1.3.1.6 Accidental Spills and Pollution Events

Accidental spills and pollution events can occur from vessels and installation techniques required for the installation and operation of the windfarm.

Green Volt will commit to undertaking construction works in adherence will all relevant best practice guidance and legislation and will prepare all necessary plans in advance of construction activities. As such, it is considered that the impact of pollution due to leaks and spills from other vessels or other plant equipment can be scoped out of the assessment.

6.1.3.2 Potential Impacts During Operation and Maintenance

The potential impacts on benthic and intertidal ecology from activities carried out during the operation and maintenance phase that are scoped in for further assessment in the EIA are:

- Permanent habitat loss

6.1.3.2.1 Permanent Habitat Loss

Permanent habitat loss will occur in the footprint of all anchors, foundations and rock cable protection, where the rock protection is situated on a sediment habitat. There may also be some loss over time associated with scour around the footprints. However, as Section 5 demonstrates, current velocity at the seabed is negligible (0.22 m/s 1-year extreme current velocity); therefore, habitat loss from scour is expected to be negligible. During operation, some disturbance on the seabed may occur during movement and drag of catenary chains in response to oceanic conditions, however due to the weight of the chains, they are likely to remain stationary for much of the time and potential movement will be limited to severe storm events.

6.1.3.3 Potential Impacts During Decommissioning

During decommissioning the potential impacts are anticipated to be similar to those for the construction phase, depending on the methods used. Potential effects from decommissioning are considered to be less than the works case effects for construction as no seabed preparation will be required, and removal of infrastructure will cause a minimal amount of material to be resuspended into the water column.

A decommissioning programme will be prepared in accordance with the requirements of the Energy Act 2004 and subject to approval by the Department of Energy and Climate Change (DECC) prior to implementation.

6.1.3.4 Potential Cumulative Impacts

The Cumulative Impact Assessment (CIA) will identify where the predicted impacts of the construction, operation, maintenance and decommissioning of the proposed Green Volt Offshore windfarm could interact with impacts from different plans or projects within the same region and impact benthic and intertidal.

The types of plans and projects to be taken into consideration are:

- Marine renewable energy (MRE) developments
- Aggregate extraction and dredging
- Licenced disposal sites
- Planned construction sub-sea cables and pipelines
- Oil and gas exploration and development
- Carbon Capture Storage activities
- Unexploded Ordnance (UXO) clearance

6.1.3.5 Transboundary Impacts

Due to the localised and small-scale nature of the impacts on benthic ecology means that significant transboundary impacts are considered to be unlikely. It is, therefore, proposed that transboundary benthic impacts are scoped out from further consideration within the EIA.

6.1.3.6 Mitigation

It is expected that the impacts upon benthic and intertidal ecology will be small scale, localised and temporary. It is not considered that there are any highly sensitive receptors within the benthic communities. If the September 2021 surveys discover any sensitive or protected habitats/species with the Windfarm Site (although highly unlikely based on evidence so far), the anchors and foundations will be micro-sited to avoid impacts.

The use of permanent project safety zone placements around well head locations and associated drill arising will significantly reduce any mobilisation of any potential bed sediments from these zones.

'*S. spinulosa'* and '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' PMF are known to be present along the southern export cable corridor option, and cable routing will be micro-sited to avoid impacts to these features.

At the export cable landfall, HDD is the preferred cable installation method, where possible. No impacts to the SAC/SPA are anticipated if HDD is used at the proposed southern cable landfall option.

6.1.3.7 Summary of Potential Impacts

Table 6.2 Summary of potential impacts to benthic and intertidal ecology (✓ = scoped in, x = scoped out)summarises the potential impacts to benthic and intertidal marine ecology scoped in and out from further assessment in the EIA.

Table 6.2 Summary of potential impacts to benthic and intertidal ecology (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Physical disturbance and temporary habitat loss of seabed habitat	✓	x	✓
Physical disturbance and temporary habitat loss of intertidal habitat	✓	x	✓
Permanent habitat loss	x	✓	x
Increased suspended sediments and sediment re-deposition	✓	x	✓
Re-mobilisation of contaminated sediment during intrusive works	✓	x	✓
Potential impacts on the Southern Trench MPA	✓	x	✓
Potential impacts on Turbot Bank MPA	x	x	x
Potential impacts on Buchan Ness to Collieston Coast SAC (and SPA habitats)	x	x	x
Accidental spills and pollution events	x	x	x
Cumulative impacts	✓	✓	✓
Transboundary impacts	x	x	x

6.1.4 Approach to Impact Assessment

6.1.4.1 Study Area

The proposed study area corresponds to two tidal ellipses from the boundary of the development (i.e. Windfarm Site, and export cable routes). This equates to approximately 20 km in a north west to a south east direction (see Section 5).

6.1.4.2 Impact Assessment Methodology for Benthic and Intertidal Habitats

In combination with guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM, 2016), the EIA Regulations provide a framework for the methodology adopted in this Chapter to assess the potential effects on benthic and intertidal habitat receptors.

Due to the complexity of ecological system processes and the uncertainty of some impacts and efficacy of some mitigation measures, experienced professional judgement also plays a key role in the evaluation of features and in determining significance of effects. The impact assessment methodology will be based on that described in Section 4.4.

6.2 Fish and Shellfish

Adult and juvenile stocks of finfish and shellfish are an important source of food for seabirds, marine mammals and other fish species; as well as being of commercial value for the fishing industry (see Section 7.3). Fish can be characterised into the following groups:

- Pelagic species, which occur in shoals, swimming in mid-water, often making extensive seasonal movements or migrations between sea areas. Pelagic species for example, include: herring *Clupea harengus*; mackerel *Scomber scombrus*; blue whiting *Micromesistius poutassou* and sprat *Sprattus sprattus.*
- Demersal species which live on or near the seabed and include, for example: cod *Gadus morhua*; haddock *Melanogrammus aeglefinus*; plaice *Pleuronectes platessa*; sandeel *Ammodytes americanus*; lemon sole *Microstomus kitt*; and whiting *Merlangius merlangus.*
- Elasmobranchs, which are cartilaginous fish and include, for example: basking shark *Cetorhinus maximus*; tope *Galeorhinus galeus*; spurdog *Squalus sp.*; skate and rays.
- Diadromous fish are those which spend part of their life at sea and part in freshwater and include, for example: Atlantic salmon *Salmo salar;* sea trout *Salmo trutta;* and European eel *Anguilla Anguilla.*
- Shellfish are generally demersal species such as shrimps, crabs, Norway lobster *Nephrops norvegicus,* mussels, and scallops.

The potential for effects on fish and shellfish, which are further discussed in this section, arise from the physical existence and operation of the windfarm; and the construction methods adopted (including seabed preparation, piling, cable protection etc).

6.2.1 Data and Information Sources

Baseline data for the EIA will be reviewed from the sources identified in Table 6.3 Other relevant peer-review publications, stock assessments, and consultation with stakeholders and fisheries organisations (such as Marine Scotland, Scottish Environment Protection Agency (SEPA), Scottish Fisherman's Federation (SFF), Cefas, Norway Directorate of Fisheries Atlantic Salmon Fisheries Board (ASFB), and River Ugie District Salmon Fisheries Board) will be considered as appropriate.

Table 6.3 Baseline Information – Fish and Shellfish

Type / description of data	Source	Status
Spawning and nursery grounds	Spawning and nursery grounds of selected fish species in UK waters mapped by Coull *et al.,* . (1998); and revised by Ellis *et al.,* .(2012).	Obtained. The spawning and nursery ground data will be further reviewed against other baseline data to consider how climate change may be influencing known specific fish spawning and nursery grounds and overall fish population dynamics associated with Green Volt Project Area.

MMO Landings Data	North Sea – Landings from various ports in the area (weight and value) by species (latest data series available at the time of writing the Scoping Report (2019).	Obtained. The data set will also be informed by the findings of research and commercial fisheries baseline environment characterisation in terms of the fish and shellfish species landed from within the Green Volt Project Area.
Species assemblage	National Biodiversity Network (NBN) Atlas	Obtained
Existing Environmental Impact Assessments (EIAs in vicinity of the Green Volt Project Area)	Ettrick and Blackbird Oil Fields EIAs (2005 – 2016) Buzzard Oil Fields EIA and survey data (2003 – 2010) NorthConnect Cable Route EIA (2018).	Obtained
Herring	International Council for the Exploration of the Sea (ICES) International Herring Larvae Survey (IHLS) data North Sea 2005 – 2021.	Obtained
Cod and Plaice	ICES Working Group 2 on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGGS2) North Sea 2004, 2009, 2010 – 2019..	Obtained
Piling impacts	Offshore Renewables Joint Industry Programme (ORJIP) study on impacts to fish from piling at offshore windfarms.	Obtained
Basking sharks	European Seabirds at Sea (ESAS) surveys (which include data on basking sharks).	Obtained
	HiDef Aerial Surveying Limited (HiDef) – site specific surveys.	Ongoing
Underwater noise on diadromous fish	Gill and Bartlett (2010); Gill *et al.*, (2012) and Popper *et al.*, 2014.	Obtained
Fish and shellfish biomass estimates in the North Sea	CEFAS data (1991 – 2014).	Obtained
Bottom trawl and beam trawl surveys	ICES data (2017).	Obtained

6.2.1.1 Site-Specific Surveys

Given that fish are highly mobile, data sets with large-scale coverage are of more relevance for characterising the natural fish and shellfish resource. A key source of information that will be used will be fisheries landings data; these provide both large spatial coverage and effort although the data have some limitations (i.e. they will be skewed towards commercial species with many non-commercial species being discarded at sea).

It is proposed that sufficient publicly available information is available to undertake a robust assessment and that site specific fish sampling surveys are not required. Data gathered during benthic ecology baseline surveys undertaken in September 2021 will be used to further inform the assessment, including:

- Full side scan sonar across the entire area;
- Feature identification and video review; and
- Grab samples at key locations.

HiDef are currently undertaking monthly aerial imagery surveys of the Project Area for marine mammals and birds (Sections 6.3 and 6.4). Any fish species recorded during the surveys will be included within the assessment.

Site specific underwater noise modelling (see Section 6.3 for details) will also be undertaken for the project for all potential underwater noise sources including but not limited to:

- clearance of UXO with and without mitigation options;
- installation of floating turbine foundations (depended on method);
- piling of pin-piles for offshore substation;
- other construction activities, including seabed preparations, rock placement and cable installation;
- vessels; and
- operational noise.

The underwater noise modelling will be used to determine the potential risk of injuring and / or displacement of fish and shellfish species; and will be used to inform the assessment for noise sensitive fish species, such as herring.

Underwater noise modelling will be undertaken using the latest and best available information, in particular relating to criteria and thresholds for predicting the noise impact ranges for fish species (Popper *et al.,* 2014):

- The SPL_{peak}, SEL_{ss} and SEL_{cum} thresholds for mortality, recoverable injury and Temporary Threshold Shift (TTS) in fish based on Popper *et al.,* (2014).
- The SEL_{cum} scenarios for fish species will be completed assuming both a stationary and fleeing receptor.

The results of the Physical Environment, Marine Water and Sediment Quality, Benthic Ecology and Commercial Fisheries assessments will be further used to inform the assessments in this topic.

6.2.2 Existing Environment

6.2.2.1 Commercial Fisheries Data

Commercial fisheries data provides an additional insight into the species found in the vicinity of the Project Area and the Offshore Export Cable Corridor.

Analysis of Marine Scotland Science (MSS) landings data (2015) highlight the landings presented in Table 6.4,

Table *6.5* and Table 6.6 for the relevant ICES rectangles (ICES Rectangle 44E9 - location of Project Area and export cable to Buzzard); (ICES Rectangle 44E8 - location of Export cable and northern landfall); and (ICES rectangle 43E8 - location of southern landfall) (MSS), 2015). These tables show all species caught within the relevant ICES rectangles and landed (over 3 tonnes), and the relevant value (British Pound Stirling (GBP). All species landed will be included within the EIA.

Table 6.4 Value (GBP) and Quantity (tonnes) of species landed from ICES rectangle 44E9 (location of Project Area and export cable to Buzzard) (MSS, 2015)

Species	Latin	Value (GBP)	Quantity (tonnes)
Scallops	Pectinidae sp.	991,462	520
Haddock	Melanogrammus aeglefinus	458,257	391
Crabs (C.P.Mixed Sexes)	Limulus polyphemus sp.	415,027	305
Lobsters	Locustam marina sp.	317,660	31
Norway Lobster	Nephrops sp.	284,848	78

Monkfish or Anglerfish	Lophius sp.	177,777	85
Mackerel	Scomber scombrus	177,718	173
Crabs - Velvet (Swim)	Necora puber	60,723	32
Whiting	Merlangius merlangus	57,152	63
Squid	Teuthid asp.	29,548	10
Lemon Sole	Microstomus kitt	17,044	9
Cod	Gadus morhua	15,601	9
Gurnards - Grey	Eutrigla gurnardus	9,178	23
Saithe	Pollachius virens	6,911	8
Plaice	Pleuronectes platessa	5,919	13
Witch	Glyptocephalus cynoglossus	5,733	6
Hake	Merluccius merluccius	3,801	4
Unidentified Dogfish	Squalus acanthias	1,434	6
Gurnards - Red	Chelidonichthys cuculus	1,130	3
Cuckoo Ray	Leucoraja naevus	1,065	3

Table 6.5 Value (GBP) and Quantity (tonnes) of species landed from ICES rectangle 44E8 (location of Export cable and northern landfall) (MSS, 2015)

Species	Latin	Value (GBP)	Quantity (tonnes)
Norway Lobster	*Nephrops sp.*	1,686,540	410
Squid	*Teuthid asp.*	1,041,445	230
Haddock	*Melanogrammus aeglefinus*	426,812	381
Crabs (C.P.Mixed Sexes)	*Limulus polyphemus sp.*	294,697	226
Scallops	*Pectinidae sp.*	249,003	130
Mackerel	*Scomber scombrus*	229,544	241
Lobsters	*Locustam marina sp.*	209,687	19
Monkfish or Anglerfish	*Lophius sp.*	136,567	68
Crabs - Velvet (Swim)	*Necora puber*	37,589	21
Whiting	*Merlangius merlangus*	35,213	39
Cod	*Gadus morhua*	23828	15
Lemon Sole	*Microstomus kitt*	16,822	9
Plaice	*Pleuronectes platessa*	14,579	30
Witch	*Glyptocephalus cynoglossus*	6,024	7
Herring	*Clupea harengus*	5,868	13
Unidentified Dogfish	*Squalus acanthias*	4,213	17
Hake	*Merluccius merluccius*	2,933	3
Gurnards - Grey	*Chelidonichthys cuculus*	1,536	4
Dabs	*Limanda limanda*	1,319	3
Cuckoo Ray	*Leucoraja naevus*	1,211	3

Table 6.6 Value (GBP) and Quantity (tonnes) of species landed from ICES rectangle 43E8 (location of southern landfall) (MSS, 2015)

Species	Latin	Value (GBP)	Quantity (tonnes)
Lobsters	Locustam marina sp.	95,314	9
Crabs (C.P.Mixed Sexes)	Limulus polyphemus sp.	86,607	73
Squid	Teuthid asp.	65,444	14
Mackerel	Scomber scombrus	12,087	15
Scallops	Pectinidae sp.	8,844	4
Crabs - Velvet (Swim)	Necora puber	7,737	3
Whelks	Buccinum undatum	4,597	5
Herring	Clupea harengus	1,178	3

Within the Project Area and Export Cable Corridor (ICES 44E9), catch was dominated by scallop, haddock, crab and mackerel, with relatively high catches of *Nephrops* and anglerfish. *Nephrops*, squid, haddock, crabs, scallops and mackerel were the main landings in ICES 44E8 (the Export Cable Corridor and northern landfall). There were fewer landings in ICES 43E8 (southern landfall), of which crabs were the greatest by weight. Overall, landings across the three ICES rectangles in 2015 were characterised by shellfish, with haddock and mackerel.

6.2.2.2 Nursery and Spawning Grounds

Data from Coull *et al.,* (1998) and Ellis *et al.,* (2012) indicate that several fish and shellfish species spawn in the vicinity of both the Project Area and the Offshore Export Cable Corridor (see Table 6.7) Figure 6.10 and Figure 6.11 show spawning and nursery grounds for identified species. To take account of climate change and fish population changes, consideration will also be made to the species recorded by landings data.

Table 6.7 Spawning and Nursery Grounds overlapping the Green Volt Project Area

Species	Project Area*		Mainland Export Cable Route*		Buzzard Export Route		Conservation Designations
	Spawning	Nursery	Spawning	Nursery	Spawning	Nursery	
Pelagic species							
Sprat	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	UK Biodiversity Action Plan (BAP)
Herring	N/A	Low intensity (Ellis)	Undetermined intensity (Coull)	Low intensity (Ellis)	N/A	Low intensity (Ellis)	PMF, UK BAP, International Union for Conservation of Nature (IUCN) (vulnerable)
Mackerel	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	PMF, UK BAP, IUCN (least concern)
Blue Whiting	N/A	Low intensity (Ellis) Undetermined intensity (Coull)	N/A	Low intensity (Ellis) Undetermined intensity (Coull)	N/A	Low intensity (Ellis) Undetermined intensity (Coull)	PMF, UK BAP, IUCN (least concern)
Demersal species							
Haddock	N/A	Undetermined intensity (Coull)	N/A	Undetermined intensity (Coull)	N/A	Undetermined intensity (Coull)	IUCN (vulnerable)
Saithe	N/A	N/A	N/A	Undetermined intensity (Coull)	N/A	N/A	PMF
European Hake	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	UK BAP
Anglerfish	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	PMF, UK BAP
Plaice	N/A	Low intensity (Ellis)	Low intensity (Ellis)	Low intensity (Ellis) Undetermined intensity (Coull)	N/A	Low intensity (Ellis)	UK BAP, IUCN (least concern)
Ling	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	PMF, UK BAP
Lemon sole	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	UK BAP
Cod	Low intensity (Ellis)	Low intensity (Ellis)	Low intensity (Ellis)	Low intensity (Ellis)	Low intensity (Ellis)	Low intensity (Ellis)	PMF, UK BAP, Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) species, IUCN (vulnerable)
Whiting	Low intensity (Ellis)	Low intensity (Ellis)	Low intensity (Ellis) Undetermined intensity (Coull)	Low intensity (Ellis) Undetermined intensity (Coull)	Low intensity (Ellis) Undetermined intensity (Coull)	Low intensity (Ellis)	PMF, UKBAP

	Undetermined intensity (Coull)						
Sandeel	Low intensity (Ellis)	Low intensity (Ellis)	High intensity (Ellis) Undetermined intensity (Coull)	Low intensity (Ellis) Undetermined intensity (Coull)	Low intensity (Ellis)	Low intensity (Ellis)	PMF, UK BAP
Norway Pout	Higher intensity (Coull)	Undetermined intensity (Coull)	Higher intensity (Coull)	Undetermined intensity (Coull)	Higher intensity (Coull)	Undetermined intensity (Coull)	PMF
Shellfish							
Nephrops	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	Undetermined intensity (Coull)	N/A
Elasmobranchs							
Tope shark	N/A	N/A	N/A	Low intensity (Ellis)	N/A	N/A	UK BAP, IUCN (vulnerable)
Common skate	N/A	N/A	N/A	Low intensity (Ellis)	N/A	N/A	Scottish Nature Conservation Marine Protected Area (MPA) search feature (marine life stages), OSPAR, UK BAP, PMF
Spotted Ray	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	OSPAR, IUCN (Least concern)
Spurdog	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	N/A	Low intensity (Ellis)	Scottish Nature Conservation MPA search feature (marine life stages), PMF, UK BAP, OSPAR, IUCN (Vulnerable)

*Data sets from Ellis *et al.*, 2012 and Coull *et.al*., 1998

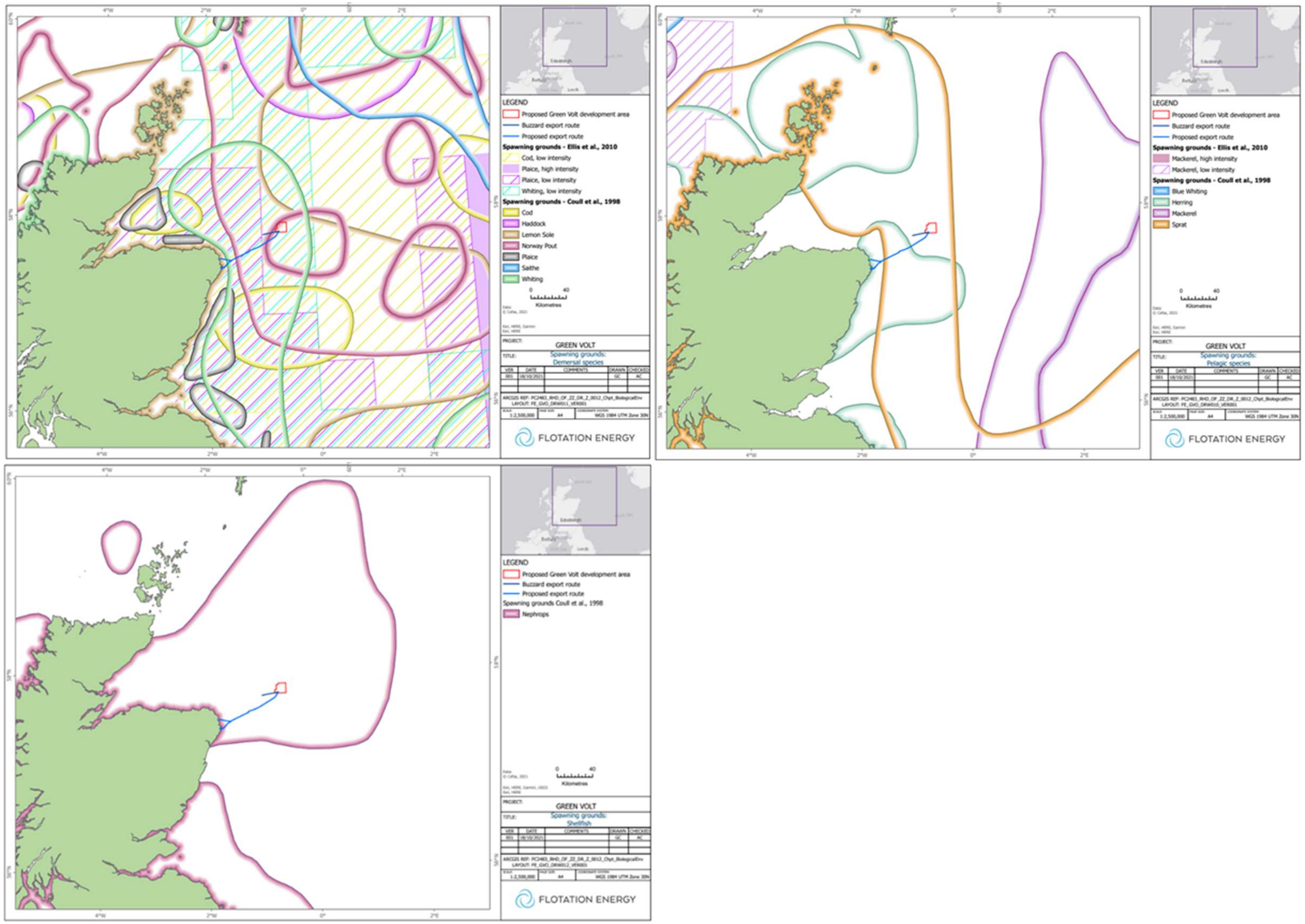


Figure 6.10 Spawning Grounds

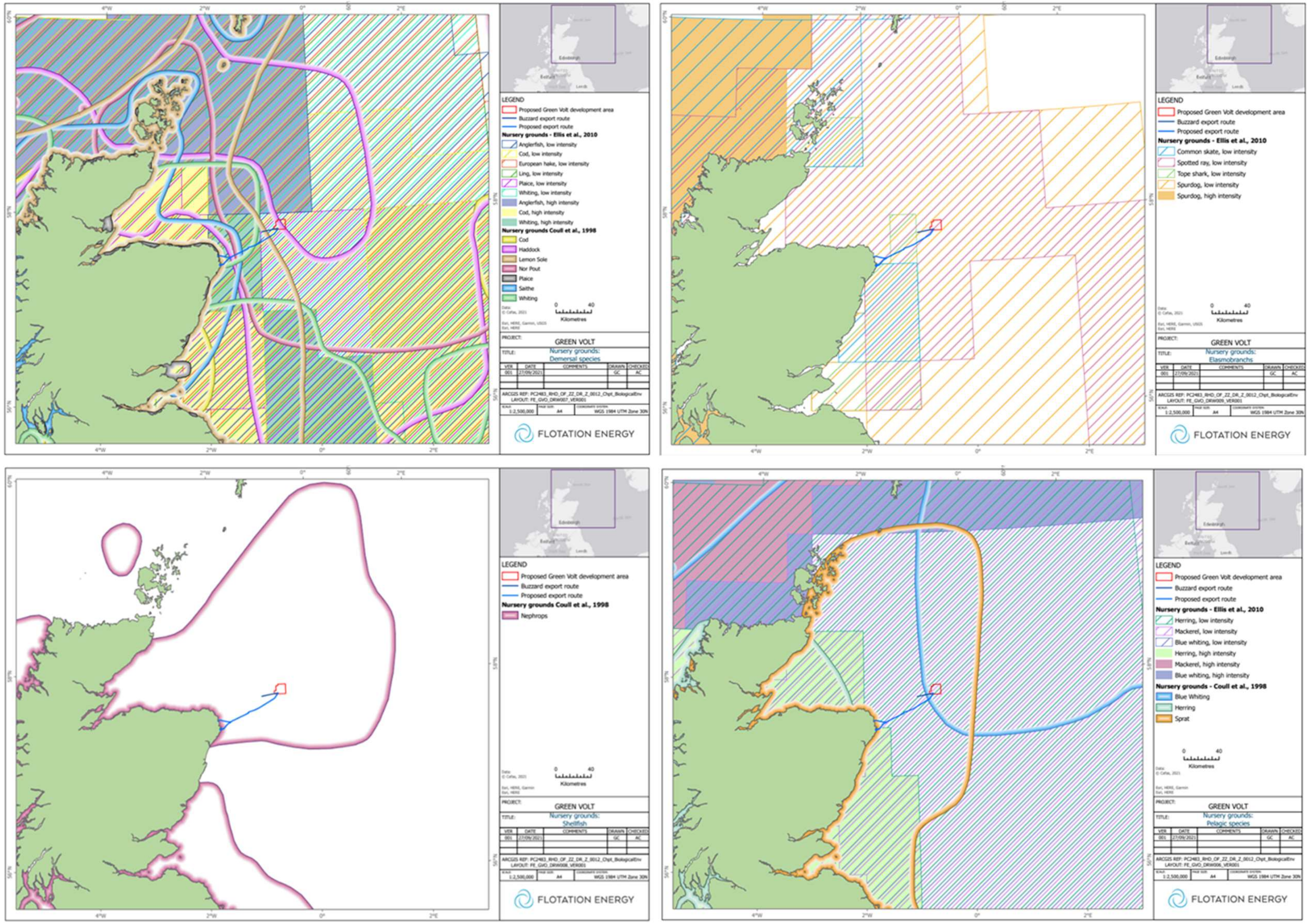


Figure 6.11 Nursery Grounds

Spawning and nursery grounds which overlap the footprint of Green Volt Offshore windfarm include the regionally commercially important species of haddock, crab, mackerel, *Nephrops* and anglerfish, as well as a number of species of ecological importance such as:

- sandeel, which is of particular value within the food chain as major predator of zooplankton and principal prey of main top predators including other fish, marine mammals and birds;
- elasmobranch species (including tope, spurdog, skates and rays) which are vulnerable due to having slow growth rates and low fecundity, with some species sensitive to effects including noise and electromagnetic fields (EMF) generated by subsea cables; and
- herring, which are particularly sensitive to noise due to a specialised adaptation which connects the swim bladder and the oesophagus to the inner ear.

Table 6.8 details the key species in the area with spawning and nursery grounds which cross the Project Area, Export Cable Route, and Buzzard Cable Route, and their spawning seasons. Those which have spawning grounds overlapping the footprint of Green Volt Offshore windfarm are identified in yellow.

Table 6.8 Spawning seasons of species in the Green Volt project footprint with overlapping spawning grounds

Species	Area of Green Volt project			Spawning season											
	Project Area	Export Cable	Buzzard Cable	J	F	M	A	M	J	J	A	S	O	N	D
Sandeel	S + N	S + N	S + N												
Herring	N	S + N	N												
Nephrops	S + N	S + N	S + N												
Cod	S + N	S + N	S + N												
Whiting	S + N	S + N	S + N												
Lemon sole	S	S + N	S + N												
Norway pout	S + N	S + N	S + N												
Sprat	S + N	S + N	S + N												
Haddock	N	N	N												
Mackerel	N	N	N					*	*	*					
Anglerfish	N	N	N												
Tope	n/a	N	n/a												
Spurdog	N	N	N												
Common skate	n/a	N	n/a												
Spotted ray	N	N	N												
Plaice	N	N	N												
Ling	N	N	N												
Blue whiting	N	N	N												
European hake	N	N	N												
Saithe	n/a	N	n/a												
Basking shark	unknown	unknown	unknown												

S = Spawning Ground, N = Nursery Ground, S+N = Spawning and Nursery

Basking shark (an elasmobranch) is also included in Table 6.8 as a sensitive and protected species, even though it would not be included in Marine Scotland's landings datasets. Basking shark is protected as a EPS, PMF, Annex II species and UK BAP species, listed as vulnerable by IUCN. Most frequent sighting of basking shark in Scottish waters are on the west coast. Sightings of basking shark were infrequent on the north east coast of Scotland during a study by Nicholson *et al.,* (2000). During the 2013 HiDef Surveys undertaken for the Kincardine Windfarm, there was only one definite sighting of a basking shark (Atkins, 2016). Scottish Natural Heritage (SNH)s data sets of observed densities of basking shark (2000-2012) do not hold any records of basking sharks in the vicinity of the Project Area. Other species of sharks, such as porbeagle shark may also transit the area.

6.2.2.3 Survey Results

To date, ocean sunfish *Mola mola* has been recorded in Project Area during the Hidef Sept 2020 surveys (HiDEF 2021).

6.2.2.4 Diadromous Fish

Diadromous fish are defined as those which spend portions of their life cycles both in freshwater and at sea. The identified diadromous fish which may pass through the Development Area and/or the Offshore Export Cable Corridor occasionally are:

- Atlantic salmon *Salmo salar;*
- Sea Trout *Salmon trutta*;
- Sea lamprey *Petromyzon marinus*;
- River lamprey *Lampetra fluviatilia*; and
- European eel *Anguilla Anguilla.*

Information on the marine distribution of these species within the Project Area and the Offshore Export Cable Corridor are limited due to gaps in the knowledge of the migratory phases of these species (Malcom *et al.,* 2010). However, from available data it may be assumed that species are more likely to be present in the Offshore Export Cable Corridor rather than the Project Area (Ellis *et al.,* 2012b), passing through the area as part of their migration route or as part of their foraging activity. The River Ugie, a spate river that enters the sea at Peterhead, Scotland (within the area of possible landfall locations for Green Volt Offshore windfarm) is a salmonid river, with sea trout entering the river in June and salmon arriving later in the season, usually September and October.

Salmon, sea trout and eels are key conservation species, Salmon and sea trout are also of recreational and commercial fishery importance. Details on salmon and sea trout fisheries are found in Section 7.3.. Salmon fishing is also an important element in Scotland's tourism industry (see Section 7.5).

The migratory nature of diadromous species means they may be sensitive to effects such as EMF generated from subsea cables. Salmonids, lamprey and eels are likely to use EMF for navigational purposes during their long migrations. There is limited knowledge on the effects of EMF on diadromous species and, therefore, a level of uncertainty in their potential interaction with EMF. Atlantic salmon and lamprey are designated features of Special Areas of Conservation (SAC) (see Section 6.2.2.6).

6.2.2.5 Freshwater Pearl Mussel

Freshwater pearl mussel is a designated feature of a number of SAC. The long-term survival of the freshwater pearl mussel depends ultimately upon host availability (Skinner *et al.,* 2003). Juvenile Atlantic salmon and sea trout are host fish of the larval stage of freshwater mussels called glochidia, attaching themselves to the gill filaments in the fast-flowing sections of rivers over July - September. Therefore, healthy populations of juvenile salmonid (salmon and sea trout) fry and parr are required to ensure their survival over winter before they drop off in May and early June. The relative importance of salmon and sea trout to the freshwater pearl mussel population varies depending on location. Potential impacts to sea trout may be similar to those for salmon.

6.2.2.6 Designated Sites

The nearest SAC designated for fish or shellfish species (either as a primary or secondary interest feature) is the River Dee, located 110 km from the proposed Green Volt Project Area. The landfalls of the export cable are the following minimum distances from a number of SAC as presented in Figure 6.12. A HRA screening exercise will be undertaken to consider possible impacts on designated sites and their features (Figure 6.12), and a review will be undertaken by Marine Scotland Licencing Operations Team (MS-LOT), in consultation with NatureScot.

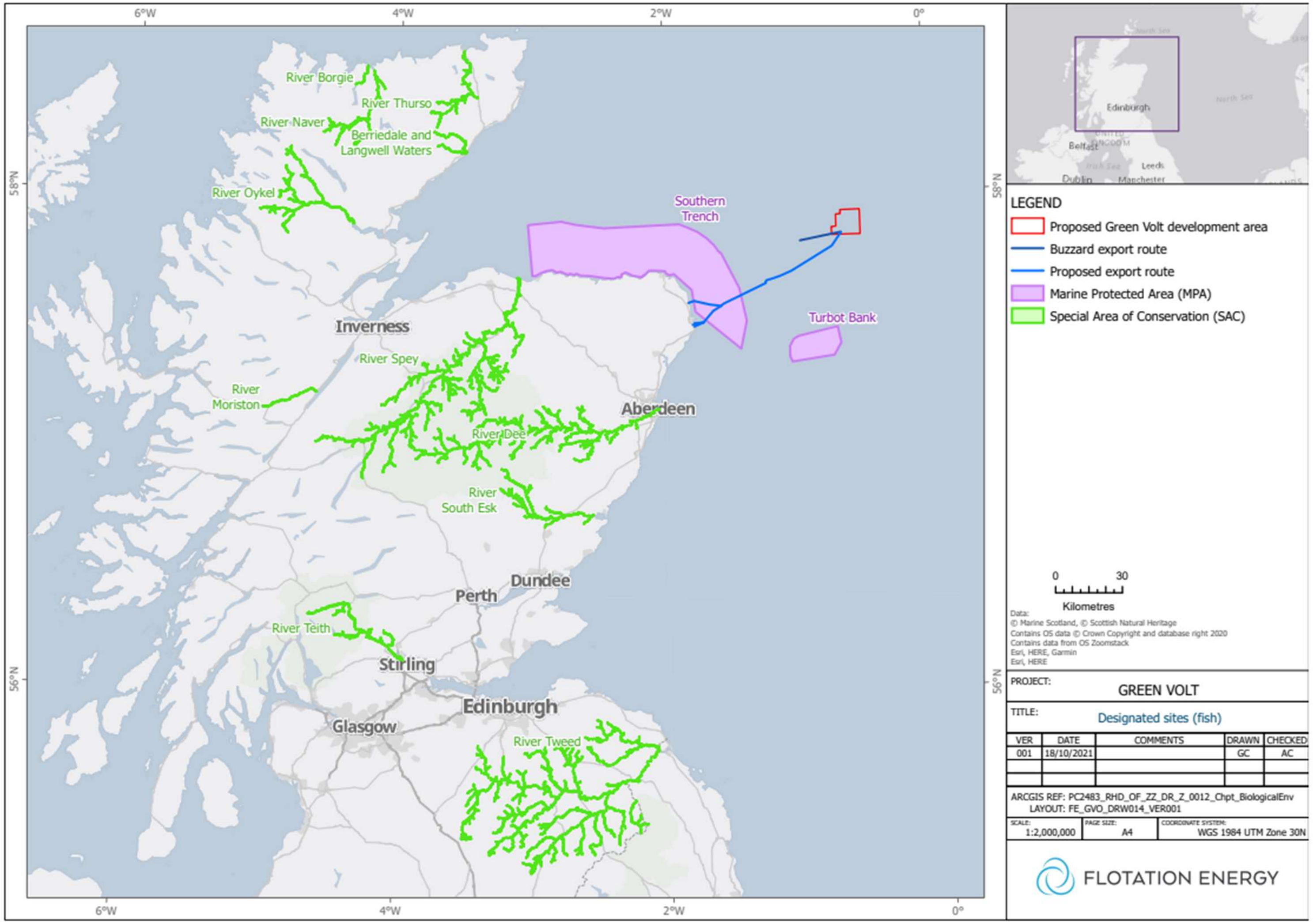


Figure 6.12 Designated Sites (Fish)

Table 6.9 Designated sites where fish are a qualifying feature (or feature of interest) screened into the HRA for further assessment

Designated site	Distance from Project boundary (km)	Species
River Dee SAC	37	Atlantic salmon Freshwater pearl mussel
River Spey SAC	84	Atlantic salmon Sea lamprey Freshwater pearl mussel
South Esk SAC	93	Atlantic salmon Freshwater pearl mussel
Tweed SAC	186	Atlantic salmon Sea, brook and river lamprey
River Teith SAC	244	Atlantic salmon Sea, brook and river lamprey
River Borgie SAC	240	Atlantic salmon Freshwater pearl mussel
Berriedale and Langwell Waters SAC	140	Atlantic Salmon
River Naver SAC	224	Atlantic salmon Freshwater pearl mussel
River Thurso SAC	150	Atlantic salmon
River Oykel SAC	167	Atlantic salmon Freshwater pearl mussel
River Moriston SAC	204	Atlantic salmon Freshwater pearl mussel

Impacts on brook lamprey are scoped out as they are freshwater species and do not cross into the marine environment for any part of their life cycle. The River Dee SAC, River Spey SAC and South Esk SAC are all screened into the HRA for further assessment. The other SAC are screened out due to distance from the project.

The STMPA, through which the Offshore Export Cable Corridor passes, was designated in 2020 and is located on the east coast of Scotland and is proposed to protect the following features:

- Minke whale (see Section 6.3 for further details)
- Burrowed mud
- Fronts
- Shelf deeps
- Quaternary of Scotland (subglacial tunnel valleys)
- Quaternary of Scotland (moraines)
- Submarine mass movement (slide scars)

The STMPA takes its name from a long deep trench which was carved out by glaciers. The trench feature functions as a nursery ground for juvenile fish and provides habitat for crustaceans including *Nephrops* and crabs. The STMPA features a dynamic mixing zone of warm and cold waters known as fronts, that attracts shoals of herring, mackerel and cod to the area and the sandy seabed habitat supports sandeels. The presence of these prey species is important for top predators like minke whale.

The conservation objectives of the STMPA are that the protected features:

(a) so far as already in favourable condition, remain in such condition,
(b) so far as not already in favourable condition, be brought into such condition, and remain in such condition

The Turbot Bank MPA is located approximately 40 km to the south west of the Project Area, and 25 km to the south of the proposed export cable route (see Figure 6.12). Turbot Bank is designated for the protection of sandeels, particularly Raitt's sand eel *Ammodytes marinus*, which provide a vital food source for larger fish, seabirds, and marine mammals.

The Conservation Objective for the MPA is (JNCC, 2018):

- so far as already in favourable condition, remain in such condition; and
- so far as not already in favourable condition, be brought into such condition, and remain in such condition.

Specifically:

"*With respect to the Sandeels, this means that the quality and quantity of its habitat and the composition of its population are such that they ensure that the population is maintained in numbers which enable it to thrive.*

Any temporary reduction of numbers is to be disregarded if the population of Sandeels is thriving and sufficiently resilient to enable its recovery from such reduction. Any alteration to that feature brought about entirely by natural processes is to be disregarded."

6.2.2.7 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

6.2.3 Potential Impacts

The potential impacts of Green Volt Offshore windfarm will consider fish and shellfish as specified in 'Guidelines for ecological impact assessment in Britain and Ireland: Terrestrial, Freshwater, Coastal and Marine and coastal. Potential impacts arise where there is a pathway between the activities required for development and the receptors (i.e. fish and shellfish).

Potential impacts on the following ecological aspects that will be considered in the assessment include:

- Impacts on fish, shellfish, eggs and larvae
- Spawning grounds
- Nursery grounds
- Feeding grounds
- Overwintering areas for crustaceans (e.g. lobster and crab)
- Migration routes, including emigrating smolts and returning adults
- Conservation Importance
- Importance in the food web
- Commercial importance

Assessment of the above impacts will be separately applied to the construction, operational and decommissioning phases. The impacts of windfarm construction will be considered separately from the Export Cable Corridor, and potential interactions considered.

6.2.3.1 Potential Impacts during Construction

Potential impacts during construction could come from:

- physical disturbance of the seabed habitats for seabed preparation for the mooring line anchors for the WTG, inter-array cables and export cable works (e.g. trenching and cable protection works);
- habitat loss from the installation of four drag embedment anchors per WTG, substation, inter-array cables and export cable works (e.g. trenching and cable protection works);

- suspension of sediment during cable and foundation installation work (including seabed preparation);
- remobilisation of contaminated sediments during intrusive works;
- disturbance or physical injury associated with underwater noise from construction and installation, including pile driving activities for the installation of the substation and seabed preparation works;
- accidental spills and pollution events; and
- changes in fishing activity.

Permanent habitat loss caused by the long-term presence of infrastructure will be considered within operational impacts to prevent double-counting.

6.2.3.2 Physical disturbance and temporary habitat loss of seabed habitat, (including spawning or nursery grounds or migratory routes) during intrusive works

There is potential for direct physical disturbance of the seabed during construction from the installation of cables and foundation (including the placement of anchors / chains) and seabed preparation. These construction phase activities have the potential to impact fish and shellfish species including species for which spawning or nursery grounds have been defined as well as those with designated conservation status. Disturbance at any particular time during the construction period will be of limited extent and duration.

It is believed that the windfarm installation periods can be designed to take into account important fish spawning seasons in the area, in particular herring as a hearing specialist species, to minimise impacts. Project benthic survey data, along with existing data, will be considered to determine the likely suitability of the seabed for spawning activities for relevant species.

The limited information on salmon and sea trout suggests that migration occurs predominantly inshore (Malcom *et al.,* 2010), for example along the River Ugie. Information suggests that most of the adult migration time is spent swimming in shallow waters (0-40 m) (Malcom *et al.,* 2010). The impact assessment for diadromous fish will, therefore, consider effects of the Export Cable Route (i.e. HDD cable laying activities) which may affect passage of these species.

The scale and nature of any impacts will potentially be small upon fish and shellfish (when compared to the wider areas available for nursery/spawning activity); and/or temporary in response to the nature of the works. However, the EIA will consider if Green Volt Offshore windfarm will have an overall significant impact upon the national, regional or population-level status of spawning or nursery habitat or activity.

The area of impact from physical disturbance and proportion of the population affected will be assessed using a worst-case scenario for the construction activities identified.

Sensitivities will be informed by available literature including the assessments available on the Marine Life Information Network (MarLIN). Assessments of sensitive species and species with conservation status are guided by review of available literature including SEA (including Rogers and Stocks, 2001).

Assessments to spawning and nursery grounds are guided by the known spawning and nursery habitats mapped by Coull *et al.,* (1998) and updated by Ellis *et al.,* (2012). The spawning and nursery ground data will be further reviewed against other baseline data to consider how climate change may be influencing known specific fish spawning and nursery grounds and overall fish population dynamics associated with the Green Volt Project Area.

Magnitude will be assessed based on the information presented in the following Sections: Physical Environment, Marine Water and Sediment Quality, and Benthic and Intertidal Ecology. The level of impact will be quantified by calculating the maximum area of disturbance as a percentage of the total available habitat, spawning or nursery area within the development and associated Export Cable Corridors according to the worst-case scenario.

Information generated as part of the metocean assessment (Section 5.3) and calculations based on the design parameters will be used to quantify the magnitude of the impact, these will include the maximum seabed area affected by seabed preparation for foundations, anchors and export, interconnecting, and inter-array cables/platform/project cable installation, cable protection and scour protection.

The assessment will be informed by results from monitoring at operational offshore windfarms to review evidence of recoverability e.g., Jensen *et al.,* 2006.

It is recognised that the proposed calculations will present a precautionary scenario which may lead to exaggerated percentage take figures; however, this is the logical way of ensuring that the absolute worst-case scenario is considered.

6.2.3.3 Re-mobilisation of contaminated sediment during intrusive works

Sediment disturbance and subsequent deposition could lead to the mobilisation of contaminants contained in those sediments which are potentially harmful to fish and shellfish species. As the Project Area is within the footprint of previous oil and gas activity there is a potential for contaminants being present in the sediments which may be released into the water column following disturbance.

Analysis of sediment chemistry as part of the Ettrick and Blackbird decommissioning programme recorded in 2007 that overall, TOM, total organic carbon (TOC), PAH alkanes and barium values were typical for this region, indicating that the background organics were predominately from a natural biogenic origin as opposed to anthropogenic sources, e.g. drill cuttings, flare drop out, etc, apart from at one well location where point source petrogenic contamination was apparent (Genesis, 2016). Barium concentrations in the Blackbird Project Area and Blackbird to Ettrick flowline route were generally below the background concentrations of barium expected in this area of the North Sea, with the exception of one sample station which showed clear evidence of barite rich drilling muds. The majority of the remaining metals analysed were present in concentrations lower than the background levels found offshore in the North Sea (away from oil and gas installations), as such, there are unlikely to be any toxicological effects evident within the benthic community at these locations (Genesis, 2016). Bottom currents are known to be low in the footprint of the Project Area (Section 5); therefore, re-mobilised contaminants are unlikely to travel far from their original location and the footprint of contamination is likely to be localised and small for each disturbance event.

The magnitude of the potential impact will be based upon the outcomes of Physical Environment and Marine Water and Sediment Quality assessments. The magnitude of the effect of sediment smothering on fish and shellfish receptors will be informed by site specific contaminant data.

Sensitivities will be informed by available literature including the assessments available on MarLIN and peer-review publications.

Impacts will be assessed in relation to background contaminant levels.

The nature, type and duration of potential construction activities will be considered to determine the magnitude of impacts.

6.2.3.4 Potential impacts on designated sites

The HRA Screening Report provides further information on the SAC designated for diadromous fish (and potential associated freshwater pearl mussel populations) which may be impacted by the project. Due to distance from the project, limited piling activities which take place 75 km offshore in deep water, and low sensitivities of diadromous fish, while disturbance may occur to individuals, an impact is not anticipated to cause SAC population level effects. As such, project specific impacts to populations from all SAC are scoped out; however, the River Dee, South Esk and River Spey SAC will be considered with regards to cumulative effects.

The provisional Offshore Export Cable Corridor runs through the STMPA and is in the vicinity of the Turbot Bank MPA.

As the cable corridor runs through the STMPA, it is not possible to scope out any impacts from the installation of the export cable to the fish species of the MPA as a food source for minke whale (see Section 6.3).

Secondary impacts on benthic habitats extends to an approximate distance of two tidal ellipses from the source, to ensure that all potential secondary impacts are captured. From Section 5, the extent of two tidal ellipses is a maximum of 20 km in a north west to a south east direction. As Turbot Bank MPA is over 25 km distance from the proposed cable corridor, and over 40 km distance from the project site, it is highly unlikely that there will be secondary impacts from construction activities to the MPA. Therefore, Turbot Bank MPA is scoped out of the EIA.

6.2.3.5 Increased suspended sediments and sediment re-deposition

Construction activities have the potential to cause mobilisation of sediments in the water column and an increase in suspended sediment concentrations (SSC). This is predominantly associated with the cable installation process, as the mooring system for floating offshore wind turbines generates very limited mobilisation of sediment when compared to a standard fixed offshore wind turbine installation process.

Where fish are unable to avoid smothering events, sensitivity to suspended sediments varies between species and life history stage and depends on sediment composition, concentration and duration of exposure. Juvenile fish are particularly sensitive to smothering events. Fish and shellfish may react through physical or reproductive decline or it may impact upon migration or spawning behaviour.

Migratory species such as Atlantic salmon, sea trout and river lamprey will experience marine, brackish and freshwater environments during their life cycle and are able to tolerate a wide range of changing parameters including salinity, dissolved oxygen and suspended sediments. Mortality of migratory fish species as a result of turbid water conditions has seldom been observed in nature and in salmonids (including Atlantic salmon and sea trout). It has been shown that turbidity increases in water bodies, although affecting some fish species to complete their migration routes, do not impact European eel (De Casamajor *et al.,* 1999). The vertical location of glass eels is also related mainly to turbidity (and phases of lunar cycle), with migrating individuals in turbid waters found through the entire water column, while in clear water they move close to the bottom of the river or seabed (De Casamajor *et al.,* 1999).

Bottom currents are limited in the Project Area (Section 5) and, therefore, suspended sediments are likely to re-settle quickly and locally to the area of disturbance.

The magnitude of the potential impact will be based upon the outcomes of Physical Environment and Marine Water and Sediment Quality. The magnitude of the effect of sediment smothering on fish and shellfish receptors will be considered in terms of a worst-case scenario (i.e. maximum area impacted, the maximum duration of smothering and the maximum thickness of deposited material).

Sensitivities will be informed by available literature including the assessments available on MarLIN and peer-review publications.

Impacts will be assessed in relation to background SSC levels and natural variations arising from storm events and seasonal changes.

The nature, type and duration of potential construction and operational activities will be considered to determine the magnitude of impacts.

6.2.3.6 Underwater noise impacts to hearing sensitive species during pile driving and other activities (vessels, seabed preparation, cable installation etc)

Potential sources of underwater noise include piling, vessel traffic, seabed preparation, rock dumping, cable installation and clearance of UXO, if required, along the cable route. Of these, piling noise is considered to have the greatest environmental impact (Nedwell *et al.,* 2007, Lindeboom *et al.,* 2011). Due to the adoption of floating WTG technology using drag embedment anchors, extensive pile driving will not be required on site, and will be limited to the substation installation. and which require relatively small diameter piles when compared to modern fixed monopile foundations Noise levels during construction offshore are expected to be lower than the same activities near shore, as in deeper water causes spherical spreading, allowing a sound wave to propagate from a source uniformly in all directions.

Noise from piling during construction (i.e. for installation of four substation foundations over an estimated period of 36 hours) has the potential to cause significant impacts to fish and shellfish species ranging from lethal trauma to behavioural changes in susceptible fish species. Herring is a species particularly sensitive to noise, and although the Project Area overlaps herring nursery grounds, it does not overlap herring spawning ground.

Apart from the installation of the substation/s, which will require a large construction vessel, the vessels used for Green Volt Offshore windfarm will be, like for Kincardine offshore windfarm (OWF), medium sized standard oil and gas vessels currently in use in and around the area, which will limit the introduction of new noise sources to the area. Construction time will also be short, with vessels spending a limited time on site to install the infrastructure.

The potential for disturbance to spawning/nursery/migration for fish and shellfish receptors will be assessed in relation to the available data on defined spawning locations and the timing and duration of the noise generated by piling events.

The qualification of the magnitude of this impact will be guided by the results of noise modelling. Assessment of sensitivities of fish and shellfish species to underwater noise will be informed by available literature (such as Popper *et al.,* 2014).

Site specific noise modelling will be undertaken to allow for modelling of noise levels generated for vessels and cable preparation. Further details are provided in Section 6.3.

Particle motion is increasingly recognised as a potentially important mechanism for effects relating to offshore developments such as wind energy, especially for those fish species more sensitive to particle motion than sound pressure (Farcas *et al.,* 2016), and to invertebrates which are only sensitive to particle motion (Miller *et al.,* 2016; Roberts & Breithaupt, 2016). There are very limited data relating to particle motion levels resulting from pile-driving during the installation of offshore windfarm foundations. Measurements were collected by Thomsen *et al.,* (2015) during the construction of an offshore windfarm in the southern North Sea; particle motion was considered to be sufficiently elevated above ambient levels within 750 m of piling locations, across most of the frequency spectrum, to be detectable by most fish species. Thomsen *et al.,* (2015) also measured the differing levels of particle motion around operational wind turbines. Levels were found to be measurably greater than background within 40 m of the turbine base, and emissions from steel monopile foundations were noted to be greater than those from jacket-based turbines. These results were not related to audibility to marine fauna. Measurements have not been taken for floating wind technology.

Particle motion will be considered within the EIA through a desk-based assessment.

6.2.3.7 Accidental spills and pollution events

Accidental spills and pollution events can occur from vessels and installation techniques required for the installation and operation of the windfarm.

Green Volt will commit to undertaking construction works in adherence will all relevant best practice guidance and legislation and will prepare all necessary plans in advance of construction activities. As such, it is considered that the impact of pollution due to leaks and spills from other vessels or other plant equipment can be scoped out of the assessment.

6.2.3.8 Changing in fishing activity

During the construction phase of Green Volt Offshore windfarm, fishing activities may be excluded from part of or the entire offshore windfarm site; however, this is likely to be insignificant, as currently no fishing activity occur within the Project Area other than transiting through the area(due to the historic oil and gas works within the footprint). and ground conditions This is discussed further in Section 7.3.

6.2.3.9 Potential Impacts during Operation and Maintenance

Similar potential impacts during operation will occur as those stated for the construction phase of Green Volt Offshore windfarm, although mostly associated with loss of habitat and changes to seabed substrata from the physical presence of infrastructure (i.e. foundations, anchor stick ups, chains, floating platforms and any inter-array or export cable protection above the seabed). Some of these effects will be of beneficial impact to fish and shellfish (i.e. through habitat creation); however, drag and scour will occur locally around the WTG anchors due to movement in the system to tidal and current conditions, which will be of negative impact to fish and shellfish resource.

Other beneficial effects may occur for fish and shellfish resources due to reduced fishing pressure in the area (although the area is currently already subject to limited fishing activity due to the historic oil and gas industry activities across the footprint of the Project Area and, therefore, a significant reduction in fishing effort is not expected (see Section 7.2).

Maintenance activities may also result in disturbance to seabed habitats, these would be similar to those during construction but at a lower magnitude.

Potential impacts from EMF from operational cables will also be considered.

6.2.3.9.1 Permanent habitat loss

Permanent habitat loss will occur in the footprint of all anchors and foundations. As cables will be buried under sediment or rock, the effects of habitat loss will be reversed in these locations. During operation, some disturbance on the seabed may occur during movement and drag of catenary chains in response to oceanic conditions; however, due to the weight of the chains, they are likely to remain stationary for much of the time and potential movement will be limited to severe storm events. There may also be some loss over time associated with scour around the footprints. However, as Section 5 demonstrates, current velocity at the seabed is negligible; therefore, habitat loss from scour is expected to be negligible.

The Kincardine Offshore Windfarm used similar technology and assessed all habitat loss impacts on fish and shellfish to be of negligible magnitude due to the temporal and spatial limitation of the Project Area.

The area of impact from physical disturbance and proportion of the population affected will be assessed using a worst-case scenario for the construction activities identified.

Sensitivities will be informed by available literature including the assessments available on MarLIN. Assessments of sensitive species and species with conservation status are guided by review of available literature including SEA (including Rogers and Stocks, 2001).

Assessments to spawning and nursery grounds are guided by the known spawning and nursery habitats mapped by Coull *et al.,* (1998) and updated by Ellis *et al.,* (2012).

Magnitude will be assessed based on the information presented in the following chapters: Physical Environment, Marine Water and Sediment Quality, and Benthic Ecology. The level of impact will be quantified by calculating the maximum area of disturbance as a percentage of the total available habitat, spawning or nursery area within the development and associated Export Cable Corridors according to the worst-case scenario.

Information generated as part of the coastal processes assessment (Section 5) and calculations based on the design parameters will be used to quantify the magnitude of the impact, these will include: The maximum sea bed area affected by the presence of infrastructure and area of influence of catenary drag.

The assessment will be informed by results from monitoring at operational offshore windfarms to review evidence of recoverability, e.g. Jensen *et al.,* 2006.

It is recognised that the proposed calculations will present a precautionary worst-case scenario which may lead to exaggerated percentage take figures, however this is the logical way of ensuring that the absolute worst-case scenario is considered.

6.2.3.9.2 Operational noise

Potential sources of operational noise include:

- operational noise from movement of floating turbine moorings on the seabed;
- maintenance activities, such as cable re-burial and any additional rock placement; and
- operation and maintenance vessel activity.

Vessels for operation and maintenance activities are likely to be medium sized vessels currently in operation within the surrounding waters, and large vessels are unlikely to be required.

Operational fixed wind turbines will produce noise and vibration which will be transmitted into the seabed and water column (Nedwell *et al.,* 2007). Measurements made at four operational windfarms (North Hoyle, Scroby Sands, Kentish Flats and Barrow) indicate that operational noise is likely to only be a few decibels above background noise within the windfarm, significantly lower in magnitude than noise produced by other activities such as dredging (CMACS 2003, Nedwell *et al.,* 2007). Resonance into the water column during operation is likely to be less on a floating unit with mooring lines than on a fixed pole structure and no noise or vibration will be transmitted into the seabed during operation for a floating offshore wind turbine.

The qualification of the magnitude of this impact will be guided by the results of noise modelling. Assessment of sensitivities of fish and shellfish species to underwater noise will be informed by available literature (such as Popper *et al.,* 2014).

6.2.3.9.3 Introduction of anchors, foundations, scour protection and hard substrate and associated fish aggregation

The presence of windfarm infrastructure (including anchors, substation towers and foundations, scour protection and cable protection) are expected to create new habitats within the windfarm colonised by a range of species with potential to increase biodiversity. The increased structural complexity from the introduced infrastructure may also provide habitat or foraging opportunities for mobile species and provide a refuge for fish and shellfish species (Hoffman *et al.,* 2000). Anti-biofouling coatings will be used on subsea infrastructure to limit colonisation.

Fish aggregation may be perceived as positive if it enhances feeding or reproductive opportunities or if it provides a habitat for species that are otherwise in a degraded state due to being habitat-limited. However, it may also be perceived as negative if fish aggregation results in increased risk of secondary entanglement (i.e. through discarded fishing gear snagging on underwater cables leading to 'ghost' fishing), or subsequently attracted predators (seabirds & mammals, respectively). Green Volt will seek evidence from the surrounding oil and gas installations and previously moored FPSO on site for any evidence of ghost fishing activity within this area which share similar moored foundation solutions. It should be noted that moored floating oil and gas systems are common in the North Sea and there is no current reported evidence of ghost fishing over the last 25 years of floating solutions being used.

Results from monitoring at other sites suggest that there are no gross changes in local fish communities as a result of operational windfarms (Gray *et al.,* 2016, MMO 2014, Ashley *et al.,* 2014, Stenberg *et al.,* 2015).

The level of magnitude of the impact will be informed by the outcomes of monitoring studies at other offshore wind developments including studies of short-term effects from monitoring reports and studies where available.

There is uncertainty as to whether artificial reefs facilitate recruitment in the local population, or whether the effects are simply a result of concentrating biomass from surrounding areas (Inger *et al.,* 2009). The level of sensitivity assigned to fish and shellfish receptors will reflect the potential of the receptor to colonise or aggregate in the vicinity of introduced artificial structures.

Assessment of sensitivities of fish and shellfish species to loss of habitat will be informed by available literature including the assessments available on MarLIN and peer-review publications.

6.2.3.9.4 Electromagnetic fields

Some species, including elasmobranchs, diadromous fish, cod and plaice utilise naturally occurring EMF for activities such as hunting prey and navigation and may be sensitive to EMF effects generated by subsea cables. CMACS (2012) concluded that any impacts would be limited to within a few metres of the cables and, therefore, would not be significant.

The cable route is unlikely to be within an important area for migrating elasmobranchs, and also represents a small area of available habitat.

The level of magnitude will be informed by the design specifications of the Green Volt Offshore windfarm sub-sea cables.

Assessment of sensitivities of fish and shellfish species to EMF will be informed by available literature including the assessments available on MarLIN and peer-review publications, including available information on migration of elasmobranchs and swimming depths, seasons, tendency to swim on or offshore, origin / destination of diadromous fish. The assessment will consider the impacts of EMF on migrations of diadromous fish, including those from SAC and the River Ugie.

6.2.3.9.5 Changing in fishing activity

During the operational phase of the Green Volt Offshore windfarm, fishing activities may be excluded from part of or the entire offshore windfarm site; however, this is likely to be insignificant, as currently only extremely low levels of fishing activity occur within the Project Area (due to the historic oil and gas works within the footprint). and also the surrounding ground conditions – note the large area to the west of the Green Volt site is also not fished and there is no oil and gas infrastructure there This has the potential to enhance fish and shellfish populations by providing refuge from fishing activities for certain species targeted by commercial fisheries in the North Sea.

6.2.3.10 Potential Impacts during Decommissioning

Potential impacts during decommissioning will be assessed as outlined in Section 2.6A decommissioning programme will be prepared in accordance with the requirements of the Energy Act 2004 (as amended), latest guidance (Scottish Government 2019b) and subject to approval by the Scottish Ministers prior to implementation.

Potential effects from decommissioning are considered to be less than the worst-case effects for construction as no seabed preparation will be required, and removal of infrastructure will cause a minimal amount of material to be resuspended into the water column.

The methods used for assessing the impacts during decommissioning will be very similar to those used during the construction phase. The operations involved will be slightly different; however, it is anticipated that the magnitude of the impacts will generally be less. Each of the impacts considered for the construction phase will be assessed for the decommissioning phase.

6.2.3.11 Potential Cumulative Impacts

The cumulative assessment will consider cumulative noise impacts, habitat loss and changes to seabed habitat.

Many of the potential cumulative impacts of offshore windfarms in the North Sea will be temporary, small scale and localised. Considering the recoverability of fish and shellfish receptors in the area, the cumulative impact of permanent loss of habitat during the operational phase of the Green Volt Offshore windfarm and other offshore windfarms is not anticipated to be significant.

However, underwater noise could have cumulative impacts spatially (if two or more piling operations are undertaken simultaneously) or temporally (if piling operations are happening consecutively) with the potential for displacement impacts across the North Sea. This could be in the form of noise ‘barriers’ blocking migration routes or consecutive piling programmes displacing sensitive fish from large areas for sustained periods. Noise modelling will be undertaken for Green Volt Offshore windfarm in isolation and cumulatively with other potential projects within the vicinity for sensitive fish species of relevance to the area. Furthermore, consideration will be given to the potential cumulative impacts from other developments in the North Sea.

The export cables will cross two active gas pipelines, one active oil pipeline, and the southern landfall option will require crossing the cable route for Hywind Offshore Windfarm. Depending on the method by which these cable crossings are protected there is potential for cumulative impacts including physical disturbance and temporary habitat loss during the construction phase, in addition to permanent habitat loss and colonisation of artificial structures during the operation phase.

There is the potential for cumulative impacts from other activities occurring in the region, these include other offshore windfarms, aggregate dredging, shipping, subsea cables, UXO clearance, licenced disposal sites, oil and gas exploration and development and carbon capture storage. Whilst it is not considered likely that there will be significant cumulative impacts, all potential impacts will be assessed as part of the EIA.

6.2.3.12 Potential Transboundary Impacts

The distribution of fish and shellfish species is independent of national geographical boundaries. The impact assessment for Green Volt Offshore windfarm will be undertaken taking account of the distribution of fish stocks and populations irrespective of national jurisdictions. As a result, it is considered that a specific assessment of transboundary effects is unnecessary. This approach was adopted and accepted for and number of other OFW developments in the North Sea, including East Anglia THREE (2015) and North Falls.

6.2.3.13 Inter-Relationships

For fish and shellfish, potential inter-relationships between impact pathways will be determined for the Project. A signposting to relevant chapters in the EIA report where these potential inter-relationship impacts have been assessed will be provided.

6.2.3.14 Interactions

The impacts identified and assessed for fish and shellfish have the potential to interact with each other, which could give rise to synergistic impacts due to that interaction. The potential interactions of impacts for the project will be assessed for marine mammals in the EIA.

6.2.3.15 Proposed Embedded Mitigation

If required, appropriate mitigation will be identified and agreed with stakeholders through the EIA and ongoing consultation with Marine Scotland and NatureScot.

To minimise impacts on the environmental, a number of mitigation measures will be embedded into the project design, in line with industry guidelines and standards. The impact assessment will be completed taking these measures into account. Potential embedded mitigation measures of relevance to fish and shellfish include:

- cables buried to a target depth in accordance with DECC Guidelines (2011) which will reduce the potential for impacts relating to EMF, and where this is not possible due to substrate conditions, cables could be shielded to an equivalent depth through rock placement or other means of burial;
- cables specified to reduce EMF emissions as per industry standards and best practice such as the relevant International Electrotechnical Commission (IEC) specifications; and
- sensitive migration or spawning times avoided, where possible, during construction, particularly for more sensitive species such as herring.

6.2.3.16 Summary of Potential Impacts

Table 6.10 outlines a summary of the potential impacts for each phase of the Green Volt Offshore windfarm that will be considered within the EIA.

Table 6.10 Summary of potential impacts to fish and shellfish (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Physical disturbance and temporary habitat loss of seabed habitat, spawning or nursery grounds or migration routes during intrusive works	✓	✓	✓
Permanent habitat loss	x	✓	x
Increased suspended sediments and sediment re-deposition	✓	x	✓
Re-mobilisation of contaminated sediment during intrusive works	✓	x	✓
Potential impacts on Designated Sites	✓	x	✓
Underwater noise impacts to hearing sensitive species during pile driving and other activities (vessels, seabed preparation, cable installation etc)	✓	✓	✓
Introduction of anchors, foundations, scour protection and hard substrate and associated fish aggregation	x	✓	x
Electromagnetic fields	x	✓	x

Accidental spills and pollution events	x	x	x
Cumulative underwater noise	✓	✓	✓
Cumulative permanent habitat loss	x	✓	✓
Cumulative changes to seabed habitat	✓	✓	✓
Cumulative impacts to designated sites	✓	✓	✓
Transboundary impacts	x	x	x

6.2.3.17 Justification for Removal from Assessment

It is proposed that the following impacts are scoped out of the EIA:

- Pollution events from accidental spills, due to the protective measures (including preparation of plans and adherence to all relevant guidance and best practice construction techniques).
- Impacts to Turbot Bank MPA are scoped out due to distance.
- Impacts to brook lamprey (designated sites) are scoped out as they are freshwater only.
- Project level impacts to SAC are scoped out due to distance

6.2.4 Approach to Impact Assessment

6.2.4.1 Study Area

The proposed study area corresponds to the ICES rectangles 43E8 (southern landfall option), 44E8 (export cable and northern landfall option) and 44E9 (Project Area, Buzzard Export Cable, Mainland Export Cable. In addition, the study area encompasses the salmon fisheries districts in closest proximity to the Green Volt Offshore windfarm (areas 13,14,15,16,17).

With regards to direct impacts on seabed habitat and associated spawning/nursery grounds, the proposed study area corresponds to two tidal ellipses from the boundary of the Development (i.e. Project Area, and export cable routes). This equates to approximately 20 km in a north west to a south east direction (see Section 5).

6.2.4.2 Impact Assessment Methodology for Fish and Shellfish

The impact assessment will use a matrix approach to assess the potential impacts for fish and shellfish following best practice and EIA guidance. In combination with guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM, 2016), the EIA Regulations provide a framework for the methodology adopted in this Chapter to assess the potential effects on fish and shellfish receptors. The impact assessment methodology will be based on that described in Section 4.4.

Receptor sensitivities will be informed by thorough review of the available peer-reviewed scientific literature, and assessments available on the MarLIN database. It is acknowledged that the MarLIN assessments have limitations. These limitations will be taken into account and other information and data accessed where relevant.

With regard to noise related impacts, the criteria adopted will be based on internationally accepted peer-reviewed evidence and criteria proposed by consensus of expert committees. Fish criteria were adopted from Popper *et al.,* (2006, 2014) and Carlson *et al.,* (2007) in terms of injury, while behavioural criteria were devised following the work of McCauley *et al.,* (2000) and Pearson *et al.,* (1992). Consideration has also been given to work by Mueller-Blenkle *et al.,* (2010), Halvorsen *et al.,* (2012) and Farcas *et al.,* (2016)

6.3 Marine Mammal Ecology

The section outlines the EIA scoping for marine mammals to determine the marine mammal species and potential impacts that will be assessed in the EIA Report.

6.3.1 Data and Information Sources

Baseline data for the EIA will be reviewed from the sources provided within this section and detailed in Table 6.11.

Table 6.11 Baseline Information – Marine Mammal Ecology

Type / description of data	Source	Status
Marine mammal abundance	Small Cetaceans in the European Atlantic and North Sea (SCANS-III): Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys (Hammond *et al.*, 2017).	Obtained
Marine mammal presence	Revised Phase III data analysis of Joint Cetacean Protocol (JCP) data resources (Paxton *et al.*, 2016).	Obtained
Marine mammal presence	Distribution maps of cetacean and seabird populations in the North-East Atlantic (Waggitt *et al.*, 2019).	Obtained
Harbour porpoise presence and density	The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area (Heinänen and Skov, 2015).	Obtained
Marine mammal observations	ORCA surveys on ferry routes from Aberdeen (ORCA, 2021).	Obtained
Marine mammal observations	Sea Watch Foundation volunteer sightings off North East Scotland (Sea Watch Foundation, 2021).	Obtained
Cetacean presence	Management Units for cetaceans in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG), 2021).	Obtained
Cetacean presence	Management Units for cetaceans in North Atlantic waters (North Atlantic Marine Mammal Commission (NAMMCO), 2020).	Obtained
Pinniped abundance and density	Special Committee on Seals (SCOS) annual reporting of scientific advice on matters related to the management of seal populations (SCOS, 2020).	Obtained
Pinniped telemetry	Seal telemetry data (Carter *et al.*, 2020; Sharples *et al.*, 2008; Russel and McConnell, 2014).	Obtained
Pinniped density	UK seal at sea density estimates and usage maps (Russell *et al.*, 2017; Carter *et al.*, 2020).	Obtained
North Sea marine mammal density in North Sea	Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters (Hague *et al.*, 2020).	Obtained
O&G marine mammal data at site	Relevant information from nearby oil and gas fields, including the Buzzard, Ettrick and Blackbird fields (Nexen, 2005, 2010, 2016; EnCana, 2003; Fugro, 2013), Kincardine Offshore Windfarm ES (Atkins, 2016) and NorthConnect ES.	Obtained

6.3.1.1 Site-Specific Surveys

Site-specific monthly aerial surveys are being conducted for both marine mammals and seabirds (initial monthly survey undertaken in May 2020). HiDef Aerial Surveying Limited (HiDef) collect high resolution aerial digital still imagery for marine megafauna (combined with ornithology surveys) over Project Area, including 4 km buffer.

The aerial surveys will be conducted between May 2020 and April 2022. The surveys will be conducted monthly. In total 24 months of data will be collected for the site. The surveys for May to September 2020 have recorded one cetacean species (harbour porpoise) and one seal species (grey seal) in the Project Area (Table 6.12).

Table 6.12 Species recorded during the HiDef arial surveys between May to September 2020

Species	Number of individuals
Harbour porpoise	157
Grey seal	1
Dolphin species	1
Cetacean species	1
Seal species	4
Seal / small cetacean species	2

Where possible, data from the site-specific surveys will be used to generate marine mammal density estimates for the Project Area. This will be considered against wider data sources from around the Project Area.

6.3.1.2 Underwater Noise Modelling

Site specific underwater noise modelling will be undertaken for the Project Area for all potential underwater noise sources, including but not limited to:

- Clearance of UXO with and without mitigation options
- Installation of floating turbine foundations (dependent on method)
- Piling of pin-piles for offshore substations
- Other construction activities, including seabed preparations, rock placement and cable installation
- Vessels
- Operational noise

The underwater noise modelling will be used to determine the potential risk of physical injury, auditory injury, disturbance and barrier effects resulting from the underwater noise.

Underwater noise modelling will be undertaken using the latest and best available information, in particular relating to criteria and thresholds for predicting the noise impact ranges for marine mammal species (Southall *et al.,* 2019) and fish species (Popper *et al.,* 2014):

- The SPL_{peak}, SEL_{ss} and SEL_{cum} thresholds based on Southall *et al.,* (2019) criteria for PTS and TTS in very high, high and low frequency cetaceans and pinnipeds in water.
- The SPL_{peak}, SEL_{ss} and SEL_{cum} thresholds for mortality, recoverable injury and TTS in fish based on Popper *et al.,* (2014).
- The SEL_{cum} scenarios for fish species will be completed assuming both a stationary and fleeing receptor, while the SEL_{cum} scenarios for marine mammals will be completed assuming a fleeing receptor.

6.3.2 Existing Environment

Initial assessments of the distribution of marine mammals throughout the North Sea have identified ten marine mammal species that occur throughout the region and in the area of the project including the export cable route and landfall (Nexen, 2005, 2010, 2016; EnCana, 2003; Fugro, 2013; Hammond *et al.,* 2017; Paxton *et al.,* 2016; Waggitt *et al.,* 2019; Hague *et al.,* 2020; SCOS, 2020; Russell *et al.,* 2017; Carter *et al.,* 2020). These include:

- Cetaceans:
    - Harbour porpoise *Phocoena phocoena*

- Bottlenose dolphin *Tursiops truncatus*
- White-beaked dolphin Lagenorhynchus albirostris
- Atlantic white-sided dolphin *Lagenorhynchus actus*[5]
- Risso's dolphin *Grampus griseous*
- Short-beaked common dolphin *Delphinus delphis*
- Killer whale *Orcinus orca*
- Minke whale *Balaenoptera acutorostrata*

- Pinnipeds:
  - Grey seal *Halichoerus grypus*
  - Harbour seal *Phoca vitulina*

Other marine mammal species that have been recorded in the North East region of Scotland include long-finned pilot whale *Globicephala melas*, sperm whale *Physeter macrocephalus*, humpback whale *Megaptera novaeangliae* and fin whale *Balaenoptera physalus* (e.g. Reid *et al.,* 2003). However, these species are likely to be in lower numbers and less frequent than the key species listed above. The results of the site specific surveys, and a full desk-based assessment, would be used to determine the species to be taken forward for further assessment. Depending on the results of the baseline assessment, some marine mammal species listed above may be scoped out of further assessment.

6.3.2.1 Cetaceans

Marine mammal information for the Ettrick, Blackbird and Buzzard fields indicates that the cetacean species that could be present in the area (Blocks 20/2a, 20/3a, 19/5, 20/1, 19/10 and 20/6 in the central North Sea) are minke whale, killer whale, bottlenose dolphin, common dolphin, white-beaked dolphin, white-sided dolphin, Risso's dolphin and harbour porpoise, based on information from UKDMap (1998) and Reid *et al.,* (2003) (Nexen, 2005, 2010, 2016; EnCana, 2003).

Marine Mammal observations during seismic survey of the Blackbird field (Blocks 20/2, 20/3, 20/7, 20/8) 15 June – 17 June 2013, recorded two unidentified dolphin species during transit, one minke whale during a seismic line, eight minke whales and ten white beaked dolphins during transit between lines (Fugro, 2013). No marine mammals were observed in the Buzzard development area prior to or during either site survey operations in July/August 2001 and March 2002 (Hydrosearch, 2002; EnCana, 2003).

Volunteer based sightings data from around Scotland is collected by various organisations through shore watches, distance sampling surveys on ferry routes and collection of casual observations. ORCA dedicated vessel-based marine mammal watches following various routes within Scottish waters (Hauge *et al.,* 2020). ORCA has been collecting survey data from the Aberdeen to Lerwick since 2016 and have recorded sightings of harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin, killer whale and minke whale within the region of the project including the export cable route and landfall. The project including the export cable route and landfall are within the East Grampian region of the Sea Watch sightings data and between the 26th July – 14th August 2021 five species of cetacean including harbour porpoise, bottlenose dolphin, common dolphin, Risso's dolphin and minke whale were recorded in the region alongside both species of seal (Sea Watch Foundation, 2021).

A large-scale survey of the presence and abundance of cetacean species around the north-east Atlantic, undertaken in the summer of 2016 (the Small Cetaceans in the European Atlantic and North Sea (SCANS)-III survey; Hammond *et al.,* 2017), indicates harbour porpoise to be the most common cetacean species present in the relevant survey blocks (R and T). Other cetacean species recorded in

---

[5] *Recorded in lower number than other marine mammal species, and considered to be less common in the area*

survey blocks R and T include bottlenose dolphin, white-beaked dolphin, white-sided dolphin and minke whale (Figure 6.13 and Table 6.13).

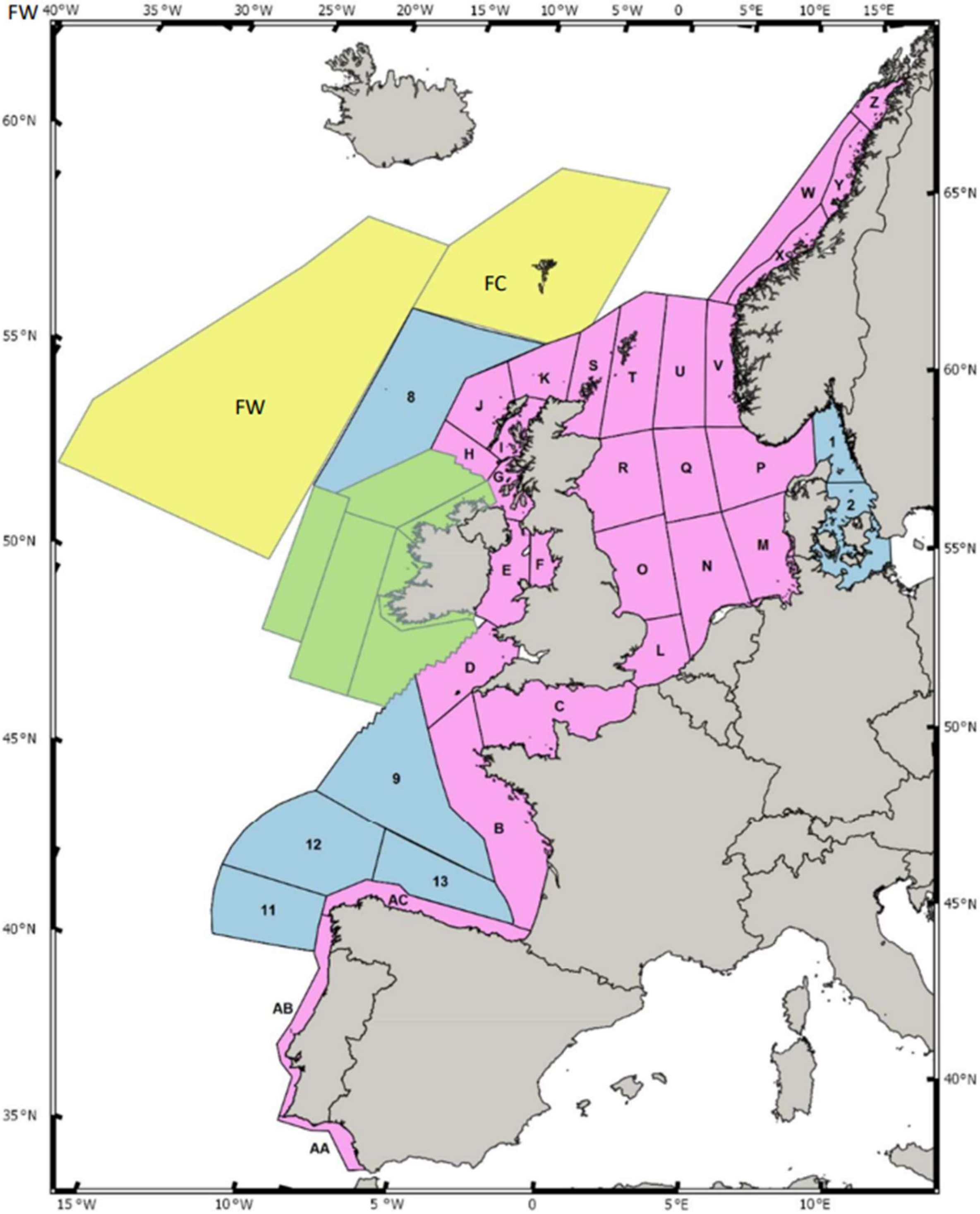


Figure 6.13 Area covered by SCANS-III and adjacent surveys. SCANS-III: pink lettered blocks were surveyed by air; blue numbered blocks were surveyed by ship. Blocks coloured green were surveyed by the Irish ObSERVE project. B (Hammond et al., 2017)

Table 6.13 SCANS-III cetacean density estimates for Survey Blocks R and T (Hammond et al., 2017)

Species	Density Estimate for SCANS-III Survey Block R	Density Estimate for SCANS-III Survey Block T
Harbour porpoise	0.599 km^2 (CV = 0.29)	0.402 km^2 (CV = 0.29)
Bottlenose dolphin	0.030 km^2 (CV = 0.86)	Not recorded
White-beaked dolphin	0.243 km^2 (CV = 0.48)	0.037 km^2 (CV = 0.46)
Atlantic white-sided dolphin	0.010 km^2 (CV = 0.99)	0.021 km^2 (CV = 0.99)
Risso's dolphin	Not recorded	Not recorded
Short-beaked common dolphin	Not recorded	Not recorded
Killer whale	Not recorded	Not recorded
Minke whale	0.039 km^2 (CV = 0.61)	0.032 km^2 (CV = 0.81)

The JCP Phase III report (Paxton *et al.,* 2016) shows similar results, with relatively high densities of harbour porpoise off north east Scotland, moderate densities of minke whale and white-beaked dolphin, and relatively low densities of bottlenose dolphin, Risso's dolphin, short-beaked common dolphin and Atlantic white-sided dolphin. Killer whale was not included within this report.

Distribution maps of cetacean species within the north-east Atlantic also indicate that harbour porpoise and white-beaked dolphin are present off north east Scotland in the highest densities, followed by Risso's dolphin, killer whale and minke whale, while bottlenose dolphin[6], short-beaked common dolphin and Atlantic white-sided dolphin are present but in lower densities (Figure 6.14; Waggitt et *al.,* 2019). The density estimates from these maps are presented in Table 6.14

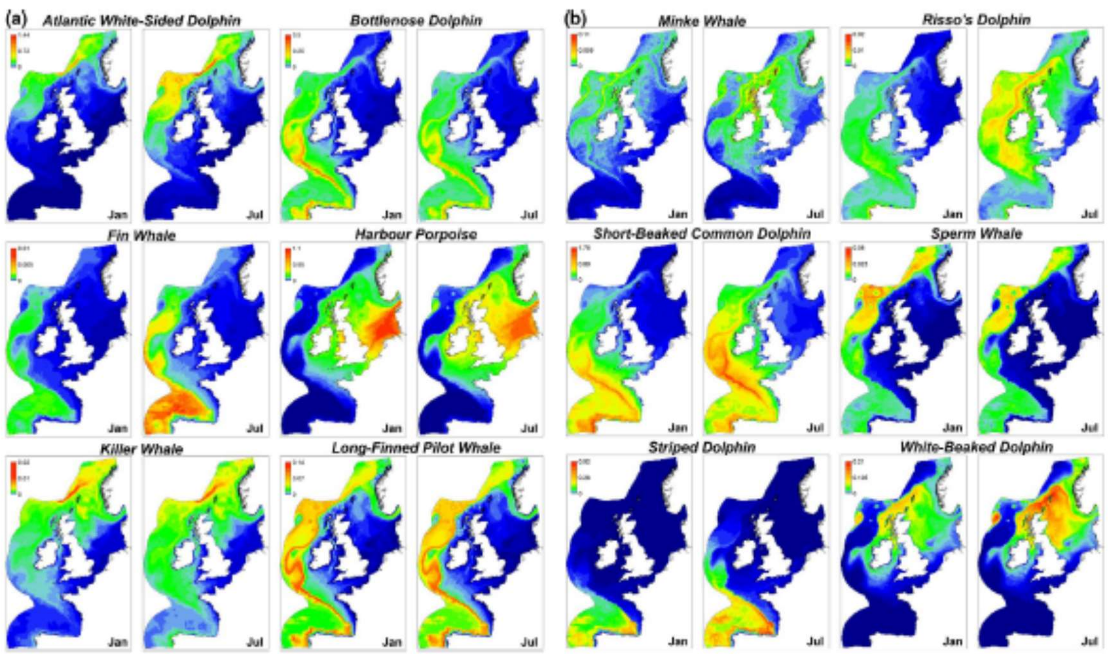


Figure 6.14 (a, b) Spatial variation in predicted densities (animals per km2) of cetacean species in January and July in the North-East Atlantic. Values are provided at 10 km resolution. A different colour gradient is used for each species. Bottlenose dolphin in (a) represent the offshore ecotype (taken from Waggitt et al., 2019)

[6] These density maps show the presence of offshore bottlenose dolphin only, and do not therefore include consideration of the resident populations around the UK and northern Europe coastlines.

Table 6.14 Cetacean density estimates for Project Area (Waggitt et al., 2019)

Species	Windfarm Project Area	Export cable route
Harbour porpoise	0.285 km2	0.287 km2
Bottlenose dolphin	0.0033 km2	0.0033 km2
White-beaked dolphin	0.092 km2	0.090 km2
Atlantic White-sided dolphin	0.028 km2	0.027 km2
Risso's dolphin	0.0012 km2	0.0011 km2
Short-beaked common dolphin	0.025 km2	0.024 km2
Killer whale	0.0016 km2	0.0014 km2
Minke whale	0.0060 km2	0.0073 km2

6.3.2.2 Pinnipeds

Grey seals are likely to present in and around the Project Area, particularly near the array location, and close to shore, and in lower numbers along the export cable route (SCOS, 2020; Russell *et al.,* 2017; Carter *et al.,* 2020).

Harbour seal are likely present in lower number around the Project Area and landfall, as harbour seal densities in the area are generally lower than for grey seal route (SCOS, 2020; Russell *et al.,* 2017; Carter *et al.,* 2020).

There are haul-out sites for grey and harbour seal in the Moray Firth and along the north east coast of Scotland (*Figure 6.15*; SCOS, 2020), therefore there is the potential for foraging seal to be in the offshore areas. The nearest major (and protected) haul-out sites are located approximately 19 km at the Ythan River mouth and approximately 116 km at Findhorn from the landfall location, for grey seal and harbour seal, respectively (*Figure 6.15*; SCOS, 2020).

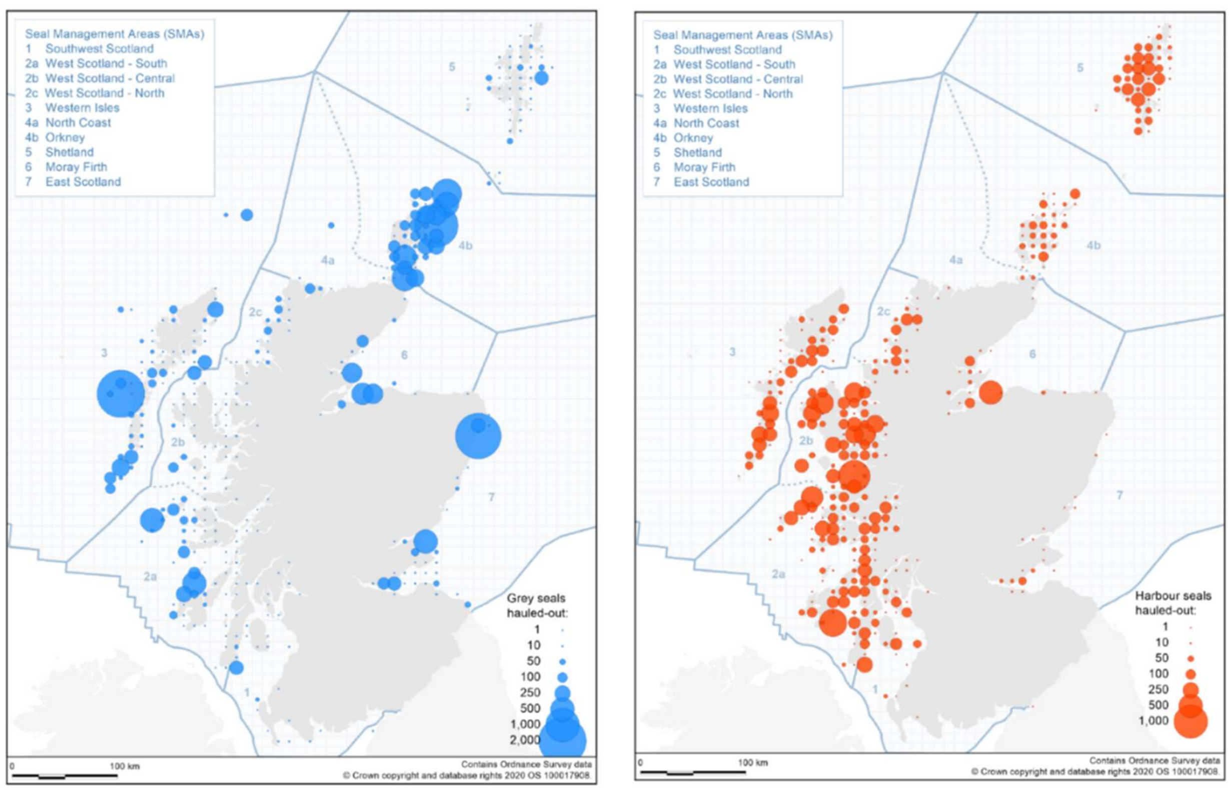


Figure 6.15 Map of (i) grey seal (blue) and (ii) harbour seal (red) distribution by 10 km squares based on haul-out counts obtained from the most recent aerial surveys carried out during the harbour seal moult in August 2016-2019 (taken from SCOS, 2020)

Global positioning system (GPS) tracking data from tagged grey and harbour seals indicates there is the potential for grey seal to be present in the Project Area and export cable route, although harbour seal are less likely to be present (*Figure 6.16*; Carter *et al.,* 2020).

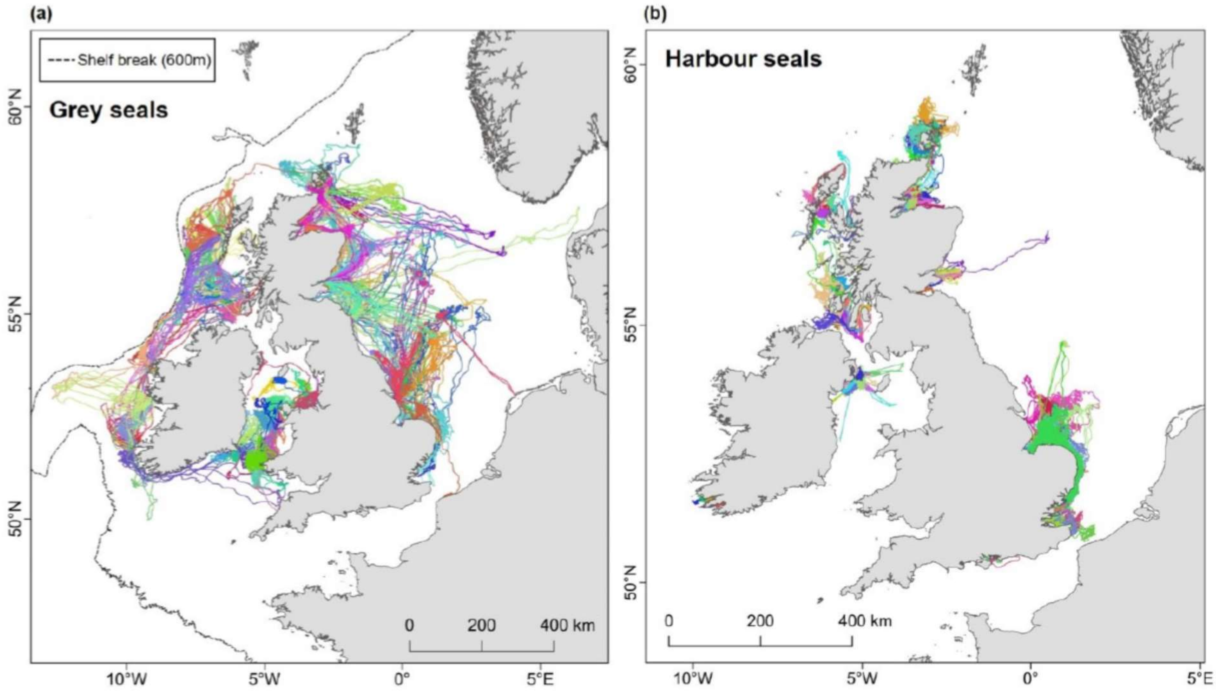


Figure 6.16 GPS tracking data for (a) grey and (b) harbour seals (taken from Carter et al., 2020)

Carter *et al.,* (2020) provides habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. The habitat preference approach predicted distribution maps provide estimates per species, on a 5 km x 5 km grid, of relative at-sea density for seals hauling-out in the British Isles. It is important to note that Carter *et al.,* (2020) provides *relative density* (i.e. percentage of at-sea population within each 5 km x 5 km grid square), whereas previous usage maps (Russel *et al.* 2017) have presented *absolute density* (i.e. number of animals).

For grey seal (Figure 6.17 (left map); Carter *et al*., 2020), the mean predicted relative density for each grid square that overlaps with the windfarm Project Area is 0.0008% of the overall population, there is a negligible relative density of grey seal within the windfarm Project Area. Within the export cable route (including all options), the mean relative density for each grid that overlaps is 0.0067% of the overall population, a low relative density. However, within the landfall areas, the relative density increases to a maximum of 0.064%, a relative density of very high when compared to the overall distributions of grey seal.

For harbour seal (Figure 6.17 (right map); Carter *et al*., 2020), the mean predicted relative density for each grid square that overlaps with the windfarm Project Area is 0.0000001% of the overall population, there is a negligible relative density of harbour seal within the windfarm Project Area. Within the export cable route (including all options), the mean relative density for each grid that overlaps is 0.0001% of the overall population, a negligible relative density. However, within the landfall areas, the relative density increases slightly to a maximum of 0.002%, a relative density of very low when compared to the overall distributions of harbour seal.

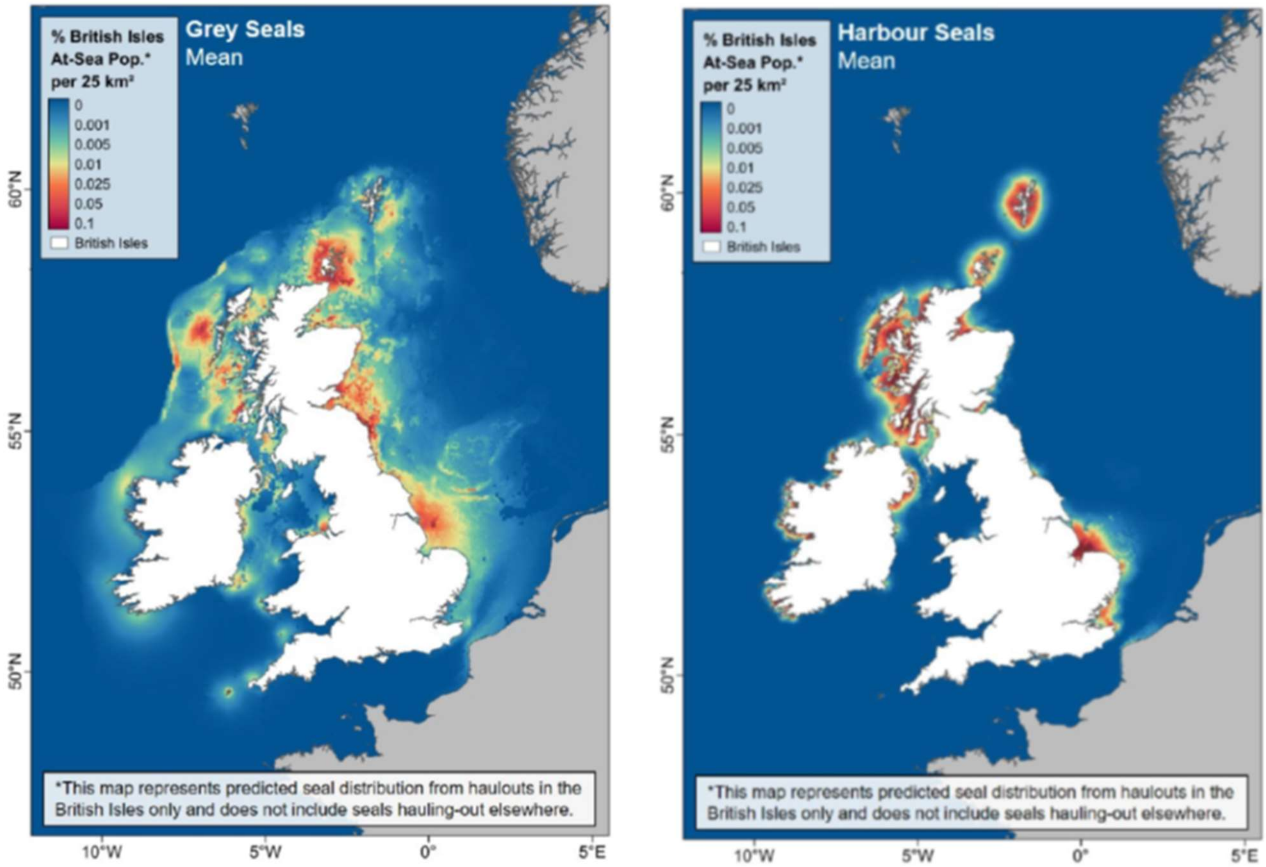


Figure 6.17 At-sea distribution of (a) grey seals and (b) harbour seal from haul-outs in the British Isles in 2018. Maps show mean percentage of at-sea population estimated to be present in each 5 km x 5 km grid cell at any one time, and the cell-wise (taken from Carter et al., 2020)

At-sea seal usage maps for grey and harbour seal, produced by the Sea Mammal Research Unit (SMRU) (Russel *et al.,* 2017), provide absolute density at a resolution of 5 km by 5 km. Therefore, this has been used for the grey and harbour seal density estimates. The estimated grey and harbour seal density estimates, based on the grid square that overlap with the offshore windfarm area and export cable route, is presented in Table 6.15 (Russell *et al.,* 2017). For both species, the density is higher within the export cable route than the windfarm Project Area, reflecting the increase in the number of seals closer to the coastline.

Table 6.15 Grey and harbour seal density estimates for Project Area (Russell et al., 2017)

Species	Windfarm Project Area	Export cable route
Grey seal	0.128 km2	0.264 km2
Harbour seal	0.0001 km2	0.0022 km2

6.3.2.3 Reference Populations

As highly mobile marine predators, the status and activity of marine mammals known to occur within or adjacent to the Project Area would be considered in the context of their Management Unit (MU) population. For cetacean species, this would be based on IAMMWG (2021), and for seal species this would be based on the latest estimates from the Special Committee on Seals (SCOS) reporting (at the time of writing, this is SCOS, 2020).

Table 6.16 summaries the relevant MU and abundance estimates (reference populations) for marine mammal species that could be present in and around the Project Area.

Table 6.16 Management Unit (MU) and abundance estimates (reference populations) for marine mammal species

Species	Management Unit (MU)	Abundance (reference population)*	Source
Harbour porpoise	North Sea (NS) MU	346,601 (CV = 0.09; 95% CI = 289,498 – 419,967)	IAMMWG (2021)
Bottlenose dolphin	Greater North Sea (GNS) MU	2,022 (CV = 0.75; 95% CI = 548 – 7,453)	IAMMWG (2021)
	Coastal East Scotland MU	189 (95% CI = 155-216)	IAMMWG (2021)
White-beaked dolphin	Celtic and Greater North Seas (CGNS) MU	43,951 (CV = 0.22; 95% CI = 28,439 – 67,924)	IAMMWG (2021)
White-sided dolphin	Celtic and Greater North Seas (CGNS) MU	18,128 (CV = 0.61; 95% CI = 6,049 – 54,323)	IAMMWG (2021)
Risso's dolphin	Celtic and Greater North Seas (CGNS) MU	12,262 (CV = 0.46; 95% CI = 5,227 – 28,764)	IAMMWG (2021)
Common dolphin	Celtic and Greater North Seas (CGNS) MU	102,656 (CV = 0.29; 95% CI = 58,932 – 178,822)	IAMMWG (2021)
Killer whale	North Atlantic	15,056; (CV=0.29 95% CI: 8,423–26,914)	NAMMCO (2020)
Minke whale	Celtic and Greater North Seas (CGNS) MU	20,118 (CV = 0.18; 95% CI = 14,061 – 28,786)	IAMMWG (2021)
Grey seal	East Scotland	3,683	SCOS (2020)
	Moray Firth	1,657	SCOS (2020)
Harbour seal	East Scotland	343	SCOS (2020)
	Moray Firth	1,077	SCOS (2020)

*CV: Coefficient of variation, CI: confidence interval

6.3.2.4 Protected Sites

Designated sites for marine mammals in the north east Scotland region and east coast of Scotland include Moray Firth SAC for bottlenose dolphin, Isle of May SAC for grey seal and Dornoch Firth and Morrich More SAC for harbour seal. Information on species' movements, including seal tagging studies, will be reviewed to determine the potential for connectivity of marine mammals from designated sites and the Project Area as part of the HRA screening.

In addition, the STMPA has been designated for minke whale, and further information on this site is provided below. Within the formal applications, the STMPA will be considered and assessed as part of the EIA process.

6.3.2.4.1 Southern Trench Nature Conservation Marine Protected Area

STMPA, through which the Offshore Export Cable Corridor passes, is located on the east coast of Scotland in the outer Moray Firth and is designated to protect minke whale, burrowed mud, fronts and shelf deeps. Fronts in the Southern Trench are created by mixing of warm and cold waters, which creates an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. NatureScot advise that, in order to conserve minke whale, the risk of injury and death should be minimised, access to resources within the site should be maintained, and supporting features should also be conserved.

The Conservation Objectives of this site are to conserve the features, specifically to ensure "*Minke whale in the Southern Trench MPA are not at significant risk from injury or killing, conserve the access to resources (e.g. for feeding) provided by the MPA for various stages of the minke whale life cycle, and conserve the distribution of minke whale within the site by avoiding significant disturbance*". The supporting features of the minke whale is also protected under these Conservation Objectives.

Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid *et al.,* 2003; Hammond *et al.,* 2017). They often prefer water depthsof up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to15 individuals) while feeding.

6.3.2.5 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

6.3.2.6 Summary of Marine Mammals in the Area

As noted above, a full assessment of the baseline conditions will be undertaken through the EIA process, and will inform, alongside the results of the site-specific aerial surveys, the species to be taken forward for further assessment. However, it is expected that the key species taken forward for assessment would be:

- Harbour porpoise
- Bottlenose dolphin
- White-beaked dolphin
- Minke whale
- Grey seal
- Harbour seal

Other marine mammal species that have been recorded in the area, although in lower number than those listed above, include Atlantic white-sided dolphin, Risso's dolphin, short-beaked common dolphin, and killer whale. The results of the baseline assessment, alongside the site-specific surveys, will inform the inclusion of these additional species.

Density estimates, where possible, will be based on date from the site-specific surveys. If this is not possible, due to low numbers, then the density estimates for cetaceans will be based on the worst-case (highest density) from the SCANS-III survey data (Table 6.13; Hammond *et al.,* 2017) or the data (Table 6.14) from Waggitt *et al.,* (2019). Seal density estimates will be based on the absolute densities from Russell *et al.,* (2017) (Table 6.15). The reference populations for cetacean species will be based on IAMMWG (2021) and NAMMCO (2020), for seal species the latest counts from SCOS (2020) will be used (Table 6.16).

6.3.3 Potential Impacts

The potential impacts from the project during the construction, operation and decommissioning phases are outlined below and summarised in Table 6.17. All of the potential impacts screened in for further assessment will be related to the potential area of effect, using marine mammal density information from site specific surveys where possible (and the most recent and robust density information publicly available from other sources) to determine the number of marine mammals that could potentially be impacted, and assessed in the context of the relevant reference populations in order to identify the potential for any population effects.

In addition, the potential for cumulative and transboundary impacts, as well as inter-relationships and interactions between impacts for the project will also be determined and assessed.

6.3.3.1 Potential Impacts During Construction

The potential impacts for marine mammals during construction scoped in for further assessments in the EIA are:

- Underwater noise
- Vessel interaction
- Disturbance at seal haul-out sites
- Change to water quality
- Changes to prey resources

The key potential impacts during construction for marine mammals are expected to be those from underwater noise. Potential impacts of underwater noise are auditory injury and disturbance. The potential for a barrier effect as a result of disturbance and displacement due to underwater noise will also be considered.

Other impacts to be considered during the construction phase would for the potential for interactions / an increase in collision risk with construction vessels. The assessment will consider potential for disturbance to seals at haul-out sites, and for any disturbance of marine mammals from foraging at sea, as well as the potential for indirect impacts as a result of changes in availability of prey species.

Potential impacts related to changes in water quality are currently scoped in for assessment; however, once further information is available on the potential for water quality changes, and the release of contaminants, including the mitigation and management measures that would be put in place, this will be assessed further to determine any potential impacts for marine mammals and their prey.

6.3.3.1.1 Underwater Noise

The potential impacts from underwater noise on marine mammals are:

- Physical injury
- Permanent auditory injury / permanent loss of hearing sensitivity (Permanent Threshold Shift (PTS))
- Temporary auditory injury / temporary loss in hearing sensitivity (Temporary Threshold Shift (TTS))
- Disturbance and behavioural effects
- Impacts on prey species
- Barrier effects

Activities that have the potential to generate underwater noise associated with the construction of the proposed project are:

- Clearance of UXO, if required, along the cable route
- Piling of the pin-piles for the offshore substation
- Installation of foundations (depending on method used)
- Other construction activities such as seabed preparation, cable laying and rock placement
- Vessels

An assessment of underwater noise will be undertaken through site specific underwater noise modelling for all potential noise sources, using the most recent and robust marine mammal thresholds (Southall *et al.,* 2019) and fish species thresholds (Popper *et al.,* 2014).

The potential impacts associated with underwater noise will be considered fully during the EIA, taking into account the most recent and robust research, guidance and information available.

A Marine Mammal Mitigation Protocol (MMMP) will be produced to reduce the risk of physical injury or permanent auditory injury (PTS) in marine mammals from underwater noise.

6.3.3.1.2 Vessel Interaction

Despite the potential for marine mammals to detect and avoid vessels, ship strikes are known to occur (Wilson *et al.,* 2007). An increase in vessels could potentially lead to an increase in vessel collision risk.

It is also important to note that the vessels during the construction phase will be vessels used in the offshore oil and gas industry, therefore marine mammals in the area will be used to the types of vessels to be used. There will not be the introduction of new vessels. Section 7.1 discusses shipping and navigation further.

The increased risk of collision with marine mammals will be given further consideration in the EIA, taking into account the most recent and robust research, guidance and information available.

6.3.3.1.3 Disturbance at Seal Haul-Out Sites

Increased activity around landfall, including vessel and human activity could have the potential to disturb seals at nearby haul-out sites, particularly during sensitive periods, such as the breeding season and moult period.

Disturbance from vessel transits to and from the proposed project also has the potential to disturb seals at haul-out sites, depending on the route and proximity to the haul-out sites.

The nearest designated seal haul-out to the proposed landfall sites is the Ythan River Mouth, designated for grey seals, approximately 21 km away. Due to the heavy vessel traffic in the vicinity of the proposed landfall sites and the distance from any designated seal haul-out sites disturbance will therefore will be scoped out of further assessment.

The potential for any disturbance of seals from haul-out sites foraging at sea will also be determined.

6.3.3.1.4 Changes to Water Quality

The increases in suspended sediments and for the accidental release of contamination during construction has the potential to impact marine mammals and their prey. However, as outlined in Section 5.5 the release of contamination in suspended sediments would be minimised by the safety exclusion zones around the old well head locations reducing the potential for changes in water quality during construction. As the impact of any changes to water quality would be localised and short lived the potential for any impacts from changes in water quality on marine mammals or their prey will not be assessed further in the EIA.

6.3.3.1.5 Changes to Prey Resource

As outlined in Section 6.2, the potential impacts on fish species and therefore the prey resource for marine mammals during construction can result from:

- Physical disturbance and temporary habitat loss of seabed habitat, spawning or nursery grounds or migration
- Permanent habitat loss
- Increased suspended sediments and sediment re-deposition
- Re-mobilisation of contaminated sediment during intrusive works
- Underwater noise impacts to hearing sensitive species during pile driving and other activities (vessels, seabed preparation, cable installation etc)
- Introduction of anchors, foundations, scour protection and hard substrate and associated fish aggregation
- Electromagnetic fields
- Cumulative underwater noise
- Cumulative permanent habitat loss
- Cumulative changes to seabed habitat

The potential for any changes to the prey resource for marine mammals during construction will be assessed further in the EIA.

6.3.3.2 Potential Impacts During Operation and Maintenance

The potential impacts for marine mammals during operation and maintenance (O&M) scoped in for further assessments in the EIA are:

- Underwater noise
- Entanglement
- Vessel interaction
- Changes to prey resources
- Physical Barrier Effects

The potential impacts for marine mammals during operation and maintenance scoped out for further assessments in the EIA are:

- Disturbance at seal haul-out sites
- Change to water quality
- EMF

Potential impacts during operation and maintenance will mostly result from underwater noise (including operational noise, maintenance activities and vessels), the risk of direct or indirect entanglement, the presence of routine vessels within the array areas and export cable corridor (leading to an increase in vessel interactions / collision risk) and the impacts on prey species. These will be similar to impacts assessed for construction, but lower in magnitude due to fewer vessels required for maintenance than construction.

As for construction, other impacts to be considered during the operation and maintenance phase would for the potential for disturbance to seals at haul-out sites, and for the disruption of foraging marine mammals would be assessed, as well as the potential for indirect impacts on prey species.

The potential for impacts from both EMF and change to water quality during operation have been scoped out. This is consistent with other recent OWF projects.

6.3.3.2.1 Underwater Noise

Potential sources of underwater noise during the operation and maintenance phase include:

- Operational noise from movement of floating turbine moorings on the seabed
- Maintenance activities, such as cable re-burial and any additional rock placement
- Operation and maintenance vessel activity

The potential for disturbance from underwater noise during the operation and maintenance phase will be based on the underwater noise modelling and assessment of similar activities for the construction phase. If suitable underwater noise data is not available for noise levels associated with the underwater noise from the floating operational turbines, then a suitable proxy such as dredging will be used.

The potential impacts associated with underwater noise during operation and maintenance (including PTS, TTS, disturbance and behavioural effects, impacts on prey species and barrier effects) will be considered further in the EIA, taking into account the most recent and robust research, guidance and information available.

6.3.3.2.2 Entanglement

Depending on the method used, there is the perceived potential for entanglement in the mooring systems for floating offshore wind turbines. To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices (Sparling *et al.,* 2013; Isaacman and Daborn, 2011), or for anchored FPSO vessels in the oil and gas industry (Bejamins *et al.,* 2014) with similar mooring lines as proposed for floating turbine structures.

The level of risk to become entangled varies with species (Benjamins *et al.,* 2014), these varying factors include:

- Body size
- Flexibility of movement
- The ability to detect mooring lines
- The feeding ecology of the species

Toothed whales have a lower risk than baleen whales, primarily due to their small size and manoeuvrability. Seal species have a similar risk level to small toothed cetaceans, with an increase in manoeuvrability.

The potential for entanglement will be assessed further in the EIA, taking into account the risk to each marine mammal species and the worst-case parameters for the mooring lines of the floating turbines.

However, given the size and physical characteristics of the mooring systems required for floating OWF, it is unlikely that upon encountering them, a marine mammal of any size would become directly entangled in the moorings themselves (note that the mooring system will remain under tension at all times and no loops, as seen in fishing gear, will ever be formed to allow entanglement with the mooring system). Mooring systems in the offshore renewables industry typically have greater diameter (Benjamins *et al.,* 2014), compared to fishing gear, which has been identified as a major entanglement risk for whales (NOAA, 2018).

Therefore, the greatest risk is most likely to be from indirect entanglement in anthropogenic debris, such as the lost, abandoned or discarded fishing gear and other marine debris, caught in the mooring lines.

6.3.3.2.3 Vessel Interaction

As outlined for construction, the increased risk of collision with marine mammals will be given further consideration in the EIA. It is anticipated that the impacts associated with vessel activities during operation and maintenance would be similar to those during the construction phase, although the magnitude of effect (number of vessels) is likely to be lower.

It is also important to note that the vessels in use during operation and maintenance will be vessels used in the offshore oil and gas industry, these are larger service operation vessels (SOV) instead of high-speed crew transfer vessels used at other OWF developments. The slower operating and transit speeds of the SOV has the potential to reduce the risk of collision. Marine mammals in the area will be habituated to the types of vessels to be used. There will not be the introduction of new vessels.

6.3.3.2.4 Changes to Prey Resource

As outlined in Section 6.2, the potential impacts on fish species and therefore the prey resource for marine mammals during operation and maintenance can result from:

- Permanent loss of habitat
- Introduction of hard substrate
- Underwater noise
- Maintenance activities
- EMF

The potential for any changes to the prey resource for marine mammals during operation and maintenance will be assessed further in the EIA.

6.3.3.2.5 Physical Barrier Effects

The presence of a windfarm could be seen as having the potential to create a physical barrier, preventing movement or migration of marine mammals between important feeding and / or breeding areas, or potentially increasing swimming distances if marine mammals circumvent the site.

The Project Area is not located on any known marine mammal migration routes.

Data from operational windfarms show no evidence of exclusion of marine mammals, including harbour porpoise and seals (e.g., Diederichs *et al.,* 2008; Lindeboom *et al.,* 2011; Marine Scotland, 2012; McConnell *et al.,* 2012; Russell *et al.,* 2014; Scheidat *et al.,* 2011; Teilmann *et al.,* 2006; Tougaard *et al.,* 2005, 2009a, 2009b).

Both harbour porpoise and seals have been shown to forage within operational fixed windfarm sites (e.g. Lindeboom *et al.,* 2011; Russell *et al.,* 2014) indicating no restriction to movements.

With the spacing between moorings of the wind turbines being greater than 1.6 km, this would allow animals to move between devices and through the operational windfarm.

However, as a precautionary approach the potential for any barrier effects as result of the physical presence of the windfarms will be considered further in the EIA. The scoping out of barrier effects from further assessments would be considered and agreed through the consultation process as the impact is not expected to be significant. Note that the potential for any acoustic barrier effects as a result of underwater noise during construction will be included as part of the underwater noise assessment.

6.3.3.2.6 Disturbance at Seal Haul-Out Sites

As outlined for construction, due to the distance from designated seal haul-out sites, there is no potential for disturbance. Therefore, this will be screened out from further assessment in the EIA.

6.3.3.2.7 Changes to Water Quality

As outlined in Section 5.5, the release of contamination in suspended sediments would be minimised by the safety exclusion zones around the old well head locations reducing the potential for changes in water quality. As the impact of any changes to water quality would be localised and short lived the potential for any impacts from changes in water quality on marine mammals or their prey will not be assessed further.

6.3.3.2.8 Electromagnetic Fields (EMF)

Studies indicate that magnetic fields decrease rapidly with vertical and horizontal distance from subsea cables and that the reduction is greater the deeper cables are buried (Normandeau *et al.,* 2011).

Although it is assumed that marine mammals are capable of detecting small differences in magnetic field strength, this is unproven and is based on circumstantial information. There is also, at present, no evidence to suggest that existing subsea cables influence cetacean movements.

Harbour porpoise are known to move in and out of the Baltic Sea, over several operating subsea cables in the Skagerrak and western Baltic Sea with no apparent effect to their migratory movements. There is also no evidence to suggest that seal species respond to EMF (Gill *et al.,* 2005).

In addition, as outlined above, data from a number of operational windfarms show no evidence of exclusion of marine mammals, including harbour porpoise and seals (e.g., Diederichs *et al.,* 2008; Lindeboom *et al.,* 2011; Marine Scotland, 2012; McConnell *et al.,* 2012; Russell *et al.,* 2014; Scheidat *et al.,* 2011; Teilmann *et al.,* 2006; Tougaard *et al.,* 2005, 2009a, 2009b).

Recent EIAs for other offshore windfarm projects only considered the impact of EMF on marine mammal prey species. Therefore, the potential for EMF to impact on marine mammal species directly will be scoped out from further assessment in the EIA, however, the potential for EMF to impact on marine mammal prey species will be considered further.

6.3.3.3 Potential Impacts During Decommissioning

During decommissioning the potential impacts are anticipated to be similar to those for the construction phase, depending on the methods used.

6.3.3.4 Potential Cumulative Impacts

The CIA will identify where the predicted impacts of the construction, operation, maintenance and decommissioning of the proposed project could interact with impacts from different plans or projects within the same region and impact marine mammals.

The types of plans and projects to be taken into consideration are:

- OWF
- Marine renewable energy (MRE) developments
- Aggregate extraction and dredging
- Licenced disposal sites
- Shipping and navigation
- Planned construction sub-sea cables and pipelines
- Potential port/harbour development
- Oil and gas development and operation, including seismic surveys
- UXO clearance

The plans and projects that will be considered in the CIA will be:

1. Located in the relevant marine mammal Management Unit (MU).
2. Offshore projects and developments, if there is the potential for cumulative impacts during the construction, operational or decommissioning of the proposed project.

The marine mammal CIA will consider projects, plans and activities which have sufficient information available to undertake the assessment.

The potential cumulative impacts that will be assessed further in the EIA are:

- Underwater noise
- Vessel interaction and entanglement
- Changes to prey resources (including habitat loss)

6.3.3.5 Transboundary Impacts

There is a significant level of marine development being undertaken or planned by EU Member States (i.e. Norway, Denmark, Germany Belgium and the Netherlands) in the North Sea. Populations of marine mammals are highly mobile and there is potential for transboundary impacts, especially when considering noise impacts.

Transboundary impacts will be assessed, where possible, in consultation with developers in other Member States to obtain up to date project information to feed into the assessment.

Transboundary impacts will be assessed, as with the other cumulative impacts, for the relevant marine mammal MUs. The potential for transboundary impacts will be addressed by considering the reference populations and potential linkages to international designated sites as identified through telemetry studies for seals and ranges and movements of cetacean species.

The assessment of the effect on the integrity of the transboundary European sites as a result of impacts on the designated marine mammal populations will be undertaken and presented in the Information for the HRA.

6.3.3.6 Inter-Relationships

For marine mammals, potential inter-relationships between impact pathways will be determined for the project. A signposting to relevant Chapters in the EIA where these potential inter-relationship impacts have been assessed will be provided.

6.3.3.7 Interactions

The impacts identified and assessed for marine mammals have the potential to interact with each other, which could give rise to synergistic impacts due to that interaction. The potential interactions of impacts for the project will be assessed for marine mammals in the EIA.

6.3.3.8 Mitigation and Monitoring

A Marine Mammal Mitigation Plan (MMMP) will be produced to reduce the risk of physical injury or permanent auditory injury (PTS) in marine mammals from underwater noise. A draft MMMP will be provided with the application. The final MMMP will be developed in the pre-construction period and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design. The MMMP will be developed in consultation with the relevant stakeholders.

If required, an EPS licence application will submitted prior to construction, for the protection of cetacean species from injury or significant disturbance.

Monitoring requirements will be agreed with the relevant stakeholders. However, it is proposed that underwater noise monitoring will be undertaken during the installation of the mooring systems and during operation of the turbines to provide background noise profiles for the floating wind turbines (as undertaken on Kincardine offshore windfarm). The noise levels will be compared to ambient noise levels and predicted noise levels used in the assessments. This data will address data gaps on the underwater noise levels for the installation and operation of floating offshore windfarms, which will be beneficial to subsequent developments.

6.3.3.9 Summary of Potential Impacts for Marine Mammals

Table 6.17 summarises the potential impacts to marine mammals scoped in and out from further assessment in the EIA.

Table 6.17 Summary of potential impacts to marine mammals (scoped in ✓, scoped out x)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Underwater noise during UXO clearance	✓	x	x
Underwater noise during foundation installation	✓	x	x
Underwater noise from other activities (for example rock placement and cable laying)	✓	✓	✓
Underwater noise and presence of vessels	✓	✓	✓
Underwater noise from operational wind turbines	x	✓	x

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Barrier effects from underwater noise	✓	✓	✓
Collision risk with vessels	✓	✓	✓
Entanglement	x	✓	x
Disturbance at seal haul-out sites	x	x	x
Changes in water quality	x	x	x
Changes to prey availability (including from habitat loss and EMF)	✓	✓	✓
Barrier effects from physical presence of windfarm	x	✓	x
Electromagnetic fields direct effects	x	x	x
Cumulative impacts from underwater noise	✓	✓	✓
Cumulative impacts from collision risk and entanglement	✓	✓	✓
Cumulative barrier impacts	x	x	x
Cumulative disturbance at seal haul-out sites	✓	✓	✓
Cumulative changes to prey availability (including habitat loss)	✓	✓	✓
Transboundary impacts	✓	✓	✓
Inter-relationships	✓	✓	✓
Interactions	✓	✓	✓

6.3.4 Approach to Impact Assessment

6.3.4.1 Consultation

Consultation is a key part of the EIA process.

As part of the consultation for the project, a Marine Mammal Expert Topic Group (ETG) will be established which aims to agree the relevance, appropriateness and sufficiency of baseline data, key issues for the EIA, and the impact assessment approach. The stakeholders to be represented on the Marine Mammal ETG will include Marine Scotland, NatureScot, University of Aberdeen Lighthouse Field Station, and JNCC. Further consultees will be agreed with the EIA project team.

Consultation with key marine mammal stakeholders will be ongoing during the EIA process, and will include discussion of the best available information to use, for example, to agree species density estimates and define reference populations for the assessments.

A schedule for the Marine Mammal ETG meetings and topics to be discussed will be prepared following feedback on this scoping report.

6.3.4.2 Impact Assessment Methodology for Marine Mammals

The impact assessment will use a matrix approach to assess the potential impacts for marine mammals following best practice and EIA guidance. The data sources summarised in Section 6.3.1 will be used to characterise the existing environment (Section 6.3.2). Each potential impact identified in Section 6.3.3 has been determined based on experience and using expert judgement. These impacts will be agreed through consultation. The impact assessment methodology will be based on that described in Section 4.4.

Receptor Value

In the case of marine mammals, most species are protected by a number of international commitments as well as European and UK law and policy. All cetaceans in UK waters are EPS and, therefore, are internationally important. Harbour porpoise, bottlenose dolphin, grey seal and harbour seals are also afforded international protection through the designation of European sites. As such, all species of marine mammal can be considered to be of high value.

Magnitude

The thresholds for defining the potential magnitude of effect that could occur from a particular impact will be determined using expert judgement, current scientific understanding of marine mammal population biology, and JNCC *et al.,* (2010) draft guidance on disturbance to EPS species. The JNCC *et al.,* (2010) EPS draft guidance suggests definitions for a 'significant group' of individuals or proportion of the population for EPS species. As such this guidance has been considered in defining the thresholds for magnitude of effects (Table 6.18).

The JNCC *et al.,* (2010) draft guidance provides some indication on how many animals may be removed from a population without causing detrimental effects to the population at Favourable Conservation Status (FCS). The JNCC *et al.,* (2010) draft guidance also provides limited consideration of temporary effects, with guidance reflecting consideration of permanent displacement.

Temporary effects are considered to be of medium magnitude at greater than 5% of the reference population. JNCC *et al.,* (2010) draft guidance considered 4% as the maximum potential growth rate in harbour porpoise, and the 'default' rate for cetaceans. Therefore, beyond natural mortality, up to 4% of the population could theoretically be permanently removed before population growth could be halted. In assigning 5% to a temporary impact in this assessment, consideration is given to uncertainty of the individual consequences of temporary disturbance.

Permanent effects with a greater than 1% of the reference population being affected within a single year are considered to be high in magnitude in this assessment. This is based on Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) and Defra advice (Defra, 2003; ASCOBANS, 2015) relating to impacts from fisheries by-catch (i.e. a permanent effect) on harbour porpoise. A threshold of 1.7% of the relevant harbour porpoise population above which a population decline is inevitable has been agreed with Parties to ASCOBANS, with an intermediate precautionary objective of reducing the impact to less than 1% of the population (Defra, 2003; ASCOBANS, 2015).

Table 6.18 Definitions of levels of magnitude for marine mammals

Magnitude	Definition
High	Permanent irreversible change to exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 1% of the reference population are anticipated to be exposed to the effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the projects). Assessment indicates that more than 5% of the reference population are anticipated to be exposed to the effect. OR Temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 10% of the reference population are anticipated to be exposed to the effect.
Medium	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.01% and 1% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the projects). Assessment indicates that between 1% and 5% of the reference population are anticipated to be exposed to the effect. OR Temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 5% and 10% of the reference population anticipated to be exposed to effect.
Low	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.001% and 0.01% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the projects). Assessment indicates that between 0.01% and 1% of the reference population are anticipated to be exposed to the effect. OR Intermittent and temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 1% and 5% of the reference population anticipated to be exposed to effect.

Magnitude	Definition
Negligible	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that less than 0.001% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more (but not permanent, e.g. limited to lifetime of the projects). Assessment indicates that less than 0.01% of the reference population are anticipated to be exposed to the effect. OR Intermittent and temporary effect (limited to the construction phase of development or project timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that less than 1% of the reference population anticipated to be exposed to effect.

6.4 Offshore Ornithology

Offshore ornithology is a key potential constraint for OWFs, due to the potential for collisions with operating WTGs and displacement of seabirds from offshore foraging areas. While individual developments may have relatively small, predicted effects, as more OWFs are taken forward, the cumulative impacts of multiple projects may have population level effects on seabirds.

The offshore ornithology impact assessment will consider potential effects on seabirds and other bird species passing through offshore areas (migratory species), due to the Project. This will be informed by analysis of site-specific survey data and expert understanding of the seasonal distribution and movements of seabirds and migratory birds in the North Sea. As well as the regional populations of seabirds and migratory bird species, consideration will be given to the potential for connectivity of the Windfarm site to statutory sites designated for nature conservation which have birds listed as qualifying features.

6.4.1 Data and Information Sources

6.4.1.1 Site-Specific Surveys

As is standard for OWFs, a two-year programme of monthly digital aerial surveys of the windfarm site and a 4 km buffer began in May 2020 and is due to complete in April 2022. Surveys of offshore birds (as well as marine mammals and other megafauna, Section 6.3) are being carried out monthly using industry standard methods to provide baseline data for the offshore ornithology assessment. The survey area (380 km^2) and transects are shown in Figure 6.18.

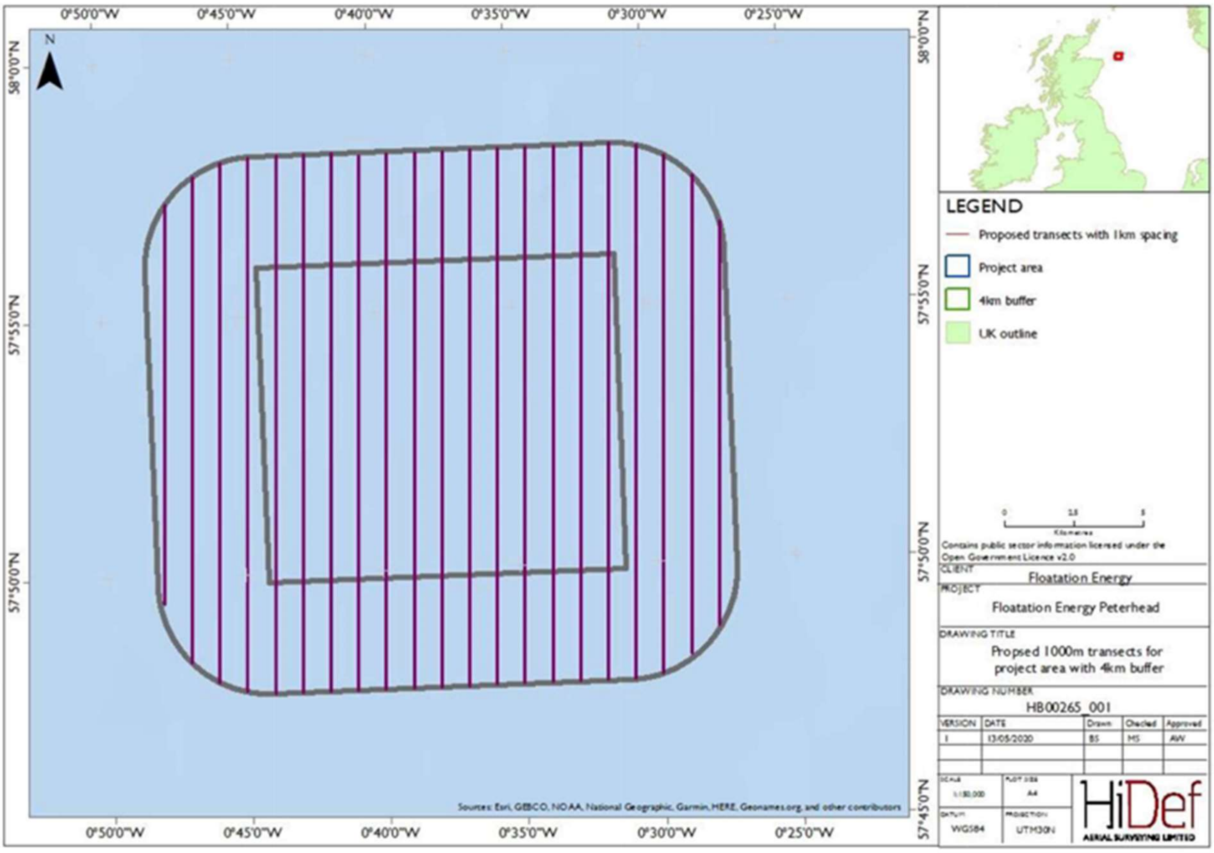


Figure 6.18 Offshore Ornithology Survey Area and Transects.

As described in Section 2.2.3, options for the landfall of the export cable north and south of Peterhead are being considered. Some of these options include landfalls within the Buchan Ness to Colliston SPA (designated for fulmar, herring gull, European shag, black-legged kittiwake, common guillemot and seabird assemblage).

As is standard practice for offshore windfarms, baseline ornithology surveys of the offshore export cable corridor are not being carried out. This is because impacts on offshore birds in the export cable corridor will be temporary and small scale, confined to the construction period and the corridor where the offshore export cable is laid, and only in a localised area or areas at any one time, where cable laying vessels and associated plant are present. However, should a location for the export cable be chosen that overlaps with the SPA, then baseline surveys of the area of overlap would be required.

6.4.1.2 Desk study

The baseline survey data is the primary data set which will be used in the assessment. Baseline data will be used in conjunction with published guidance, research and datasets. These will include, but are not limited to, those listed in Table 6.19 Baseline information – Offshore Ornithology. Any relevant new guidance, studies and research which become available during the timescale for the EIA will be added.

Table 6.19 Baseline information – Offshore Ornithology

Type/description of data/information	Source	Status
Guidance and research – sensitivity of birds to OWFs	Wade *et al*. 2016; Furness *et al*., 2013; Furness and Wade 2012; Langston 2010; Stienen *et al*., 2007; Drewitt and Langston 2006; Garthe and Hüppop 2004.	Obtained
Guidance, research and methodology – OWF displacement / barrier effects on birds	SNCBs 2017; Dierschke *et al*. 2016; Masden *et al*. 2012, 2010; Speakman *et al*., 2009.	Obtained
Guidance, research and methodology – collision risk modelling, flight heights and avoidance rates for birds and OWFs, including the Band deterministic model, the stochastic model and the migratory species model	Bowgen and Cook 2018; MacGregor *et al*., 2018; Skov et al. 2018; Cook *et al*. 2014; Johnston *et al*., 2014a and b; SNCBs 2014; Band 2012; Wright *et al*., 2012; Cook *et al*. 2012. It is noted that a recent review and recommendations for revised avoidance rates (Cook 2021), commissioned by Natural England, has been withdrawn.	Obtained / available as online tools
Population viability analysis modelling tool for seabirds	Searle *et al*. 2019.	Available as an online tool
Seabird foraging ranges and distribution at sea	Cleasby *et al*., 2020, 2018; Waggit *et al*., 2019; Woodward *et al*. 2019; Wakefield *et al*., 2017, 2013; Kober *et al*., 2010; Stone *et al*. 1995, specific tracking studies for north east Scotland seabird breeding colonies e.g. MacArthur Green (2018, 2019).	Obtained / to be sourced as required
Bird population estimates	Furness 2015; Mitchell *et al*. 2004; JNCC seabird monitoring programme database; designated site citations / departmental briefs / conservation advice from the websites of SNCBs.	Obtained / available online
Information and data for cumulative (and in combination (HRA)) assessment	Relevant documents from marine licence applications for other OWFs in UK offshore waters (in particular Scottish and English East Coast Waters), and Transboundary OWFs	Obtained / available online / to be sourced as required
Other empirical evidence and studies relevant to assessment	Relevant ecological studies for species included in EIA (peer reviewed scientific papers and 'grey' literature), including post-construction monitoring studies (e.g. Moray Firth Regional Advisory Group https://marine.gov.scot/ml/moray-firth-regional-advisory-group-mfrag), Kincardine OWF bird collision study (KOWL, 2019).	Obtained / to be sourced as appropriate

Type/description of data/information	Source	Status
Other relevant strategy and policy documents	For example, published documents relating to Scottish Government plans for offshore wind energy (ABPmer 2019, Scottish Government 2020),	Obtained / to be sourced as appropriate

6.4.2 Existing Environment

This section presents an overview of the existing environment and key bird species likely to be present at the Project Area. This is based on species recorded to date during baseline surveys (which began in May 2021), EIAs for OWFs in close proximity to the Green Volt Offshore windfarm, the location and reasons for designation of nearby Special Protection Areas (SPAs) in the North Sea, and other sources as cited.

The Project Area is situated in the North Sea, about 75 km (closest point to land) to 90 km off Peterhead in Aberdeenshire (Figure 1.3)

The North Sea is important for seabirds throughout the year, providing foraging grounds for seabirds breeding in adjoining coastal areas during the breeding season, from colonies further afield in the non-breeding season, and for sub-adult birds (pre-breeding age) throughout the year. Overall, at least 19 seabird species breed on coastal areas around the North Sea, including large populations of gannet, kittiwake and guillemot (ICES 2021).

At the time of writing, results from baseline surveys are available for the period May to September 2020 only. During these months, which overlap with the mid to late breeding season and autumn passage period, the species recorded regularly and in the largest numbers were (in order of decreasing abundance):

- guillemot *Uria aalge*,
- fulmar *Fulmaris glacialis*,
- kittiwake *Rissa tridactyla*,
- razorbill *Alca torda*,
- gannet *Morus bassanus*, and
- puffin *Fratercula arctica*.

Other species recorded occasionally and in small numbers (monthly counts of 6 or less) were:

- Arctic tern *Sterna paradisaea*,
- common gull *Larus canus*,
- great black-backed gull *Larus marinus*,
- great skua *Stercorarius skua*,
- herring gull *Larus argentatus*,
- little gull *Hydrocoloeus minutus*,
- lesser black-backed gull *Larus fuscus*,
- Manx shearwater *Puffinus puffinus*,
- red-throated diver *Gavia stellate*, and
- storm petrel *Hydrobates pelagicus*.

The six most regularly recorded species are consistent with the suite of species expected to be present during the breeding season given the species assemblages present at the closest seabird breeding colonies on the Anberdeenshire and Moray Firth coasts of Scotland (Buchan Ness to Collieston Coast; Troup Pennan and Lions Heads, Fowlsheugh and East and North Caithness Cliffs (see site information on NatureScot SiteLink https://sitelink.nature.scot/home; more detail on these and other SPAs is included in the HRA Screening report). Based on foraging range data (Woodward *et al*. 2019), at 75 km offshore the Project Area is beyond the distances regularly travelled by other species breeding at one or more of these colonies in large numbers, such as herring gull, greater black-backed gull and shag.

The seabirds recorded less frequently are in line with expectations for species passing through this area of the North Sea on migration to or from breeding colonies (e.g. with reference to Furness 2015).

The list of species recorded in surveys to date at the Green Volt Offshore Windfarm is almost exactly the same as the species recorded during boat-based surveys of the nearby Hywind OWF during 2013-2014 (Natural Research Projects 2015). Hywind is about 55 km south of the proposed Green Volt Offshore windfarm site, and at about 25 km from Peterhead. Compared with the Green Volt Offshore windfarm surveys to date, little gull was not recorded at Hywind and one additional species, Arctic skua, was present. On this basis, it is unlikely that further surveys at Green Volt Offshore Windfarm will result in substantial additions to the seabird species to be considered in the assessment, although of course the further surveys will provide essential information on year round abundance of birds at the proposed Project Area. The six regularly recorded species are likely to be the key species scoped in for assessment in the EIA.

6.4.2.1 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

6.4.3 Potential Impacts

Possible impacts on offshore birds from the construction, operation and development of the Green Volt Offshore Windfarm are shown in Table 6.20. These are the industry-standard impacts typically included in offshore ornithology assessments for EIA in the UK.

Table 6.20 Summary of potential impacts to offshore ornithology (✓= scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Direct disturbance and displacement	✓	✓	✓
Displacement / barrier	x	✓	x
Collision	x	✓	x
Indirect effects via prey / habitats	✓	✓	✓
Cumulative	✓	✓	✓
Transboundary	x	✓	x

6.4.3.1 Construction

The key potential impacts during construction will come from disturbance and consequent displacement of birds due to construction activities. There is the potential for noise and visual disturbance to birds from the presence, movements and lighting of vessels, helicopters, and other plant during the installation of offshore infrastructure within the windfarm site and the export cable corridor. Construction disturbance and displacement will be temporary and localised around areas that are the focus of construction activity at a given time.

Indirect impacts on birds through changes in prey or habitat availability will also be considered.

6.4.3.2 Operation

The key potential impacts during operation will result from the presence of WTGs and offshore infrastructure.

Birds which perceive the turbine array of an OWF as a barrier and decide not to enter will be displaced from the windfarm site. For birds which regularly encounter the windfarm, for example breeding seabirds making foraging trips from nearby colonies, displacement may affect survival rates through reduced energy intake from foraging if birds are displaced from preferred feeding areas, and/or increased energy expenditure due to avoidance of the windfarm site. Studies of the effects of OWFs on seabirds indicate that for some species, densities within constructed OWFs are lower than those recorded in pre-construction surveys, and/or when compared with nearby offshore areas. For these species it appears that some individuals may choose to enter an OWF, but others may not. In reviewing studies of seabird responses to OWFs, Dierschke *et al*. (2016) identify species which strongly or almost completely avoid them, species showing weak avoidance, species which are hardly affected or where avoidance and attraction are approximately equal over studies, and species weakly or strongly attracted to OWFs.

Migratory species flying between breeding and non-breeding areas may fly over or around the windfarm site if they perceive it to be a barrier, which may have consequences through increased energy costs of flight.

Birds which are not displaced and fly through an OWF at a height equivalent to that of the rotating blades will be at risk of collision with operational WTGs. Collisions are likely to result in direct mortality. Studies indicate that collisions do occur but are rare events (e.g. Skov *et al*. 2018), hence assessment involves modelling the risk of collision for individual species.

Displacement and disturbance associated with vessels and maintenance activity and indirect impacts on seabirds via prey and habitats will also be considered.

6.4.3.3 Decommissioning

During decommissioning the potential impacts are anticipated to be similar to those described above for the construction phase.

6.4.3.4 Cumulative impacts

The cumulative assessment will identify which impacts assessed for the Project alone have the potential for a cumulative impact with other plans and projects. For each impact screened in for cumulative assessment, the plans / projects with potential to contribute to the impact will be identified and assessed as per the impact assessment methodology for project alone impacts. Based on experience of other OWF projects, it is expected that the cumulative assessment will focus on cumulative displacement / barrier effects and cumulative collision risk due to the presence of offshore infrastructure when considered alongside other OWF projects.

6.4.3.5 Transboundary impacts

Given the wide-ranging nature of seabirds (especially in the non-breeding season) and migratory birds, some of the offshore ornithology receptors considered within the project alone and cumulative impact assessments may also potentially encounter OWFs located outside UK territorial waters, giving the potential for transboundary impacts. The area of search for Transboundary OWFs is likely to be the North Sea. Transboundary OWFs will be screened for the potential to impact on the same bird populations as are present at Green Volt. If sites are screened in, impacts will be assessed as per the other cumulative impacts.

6.4.4 Approach to Impact Assessment

The impact assessment methodology will be based on that described in Section 4.4, adapted to make it applicable to assessment of ornithological receptors.

The EIA baseline will identify the seasonal use of the site by the bird species recorded in aerial surveys. The surveys will provide information on the abundance, distribution, behaviour, location, numbers, sex and age (where possible) and flight direction of bird species (or species-groups if species identification is not possible from aerial images). Detailed analyses of survey data will provide density and abundance estimates (with associated confidence intervals and levels of precision) for key ornithological receptors within the Windfarm Site and buffer.

Flight height data derived from the aerial surveys will be provided. However, owing to the technical difficulties in estimating flight height from aerial imagery, it is anticipated that generic flight data (Johnston *et al*. 2014a, 2014b) will be used in the collision risk model (subject to discussion with stakeholders).

The impact assessment will be undertaken in line with industry standard guidance (CIEEM 2018). The sensitivity of each species to each of the potential impacts listed above will be determined based on the size of its seasonal populations, its conservation status, its known sensitivity to OWFs and its ecological characteristics (e.g. auk flight heights are almost exclusively below rotor height and therefore these species have negligible collision risk and would be screened out for this impact). Species identified as key ornithological receptors for a given impact will be subject to full assessment.

Quantitative assessment methods will be used, including:

- Displacement matrices combining ranges of displacement and mortality to obtain estimates of displacement mortality (SNCBs 2017);
- Collision risk modelling for seabirds using the deterministic Band model (Band 2012), and/or the stochastic model (McGregor 2018), and the migratory birds collision risk tool for migratory species (Wright et al. 2012); the use of appropriate models will be discussed with relevant stakeholders though the Evidence Plan Process; and
- Population Viability Analysis to provide predictions of the population consequences of the impacts for the Projects alone and also cumulatively with other windfarms; it is expected that the NE population modelling tool (Searle *et al*. 2019) will be used.

The detailed methodology and scope of the impact assessment, and reference population sizes for each species, will be based on the best available information at the time of undertaking the assessment and will be subject to consultation with key stakeholders.

7 The Human Environment

7.1 Seascape, Landscape and Visual Resources

This section was produced by Dr Richard Wakefield of Flotation Energy.

7.1.1 Existing Environment

To confirm the baseline environments for both the offshore and landfall elements of the Green Volt Offshore windfarm, a Zones of Theoretical Visibility (ZTV) has been prepared for the development site and a summary of the potential seascape, landscape, and visual impact assessment (SLVIA) during the export cable installation in the near shore environment has been reviewed. These are described below:

- Seascape, landscape, visual resources array study development area: UK guidance (SNH, 2017) on the landscape and visual effects of an offshore windfarm recommends a study area of a 50 km radius for wind turbines. This reflects the distance that wind turbines of this height would potentially be visible to the human eye. A preliminary offshore landscape and visual ZTV has been prepared to a 50 km radius from the outer boundary of the array area to ensure that all coastal landscape and visual, and cultural heritage setting receptors that may experience significant effects are identified.
- Seascape, landscape, visual resources proposed export cable corridor has not been considered as the laying of the export cable as this will be a short-term (days/weeks) activity where a cable lay vessel will be deployed to lay the cable in a continuous operation from the development area (>75 km offshore) to the onshore connection point in a continuous operation. It is noted that the marine space around Peterhead has significant vessel traffic, including large marine cable lay vessels.

7.1.1.1 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

7.1.2 Potential Impacts

The 50 km ZTV assessment is presented in Figure 7.1 and shows that as the development site is located well outside the maximum 50 km potential ZTV range of any coastal location. Therefore, no additional SLVIA assessment is required for the Windfarm Site.

Possible impacts relating to the potential changes to the SLVIA of the area are considered in Table 7.1.

Table 7.1 Summary of potential impacts to SLVIA (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
SLVIA offshore (Windfarm Site)	x	x	x
SLVIA onshore cable landing (export cable)	x	x	x

7.1.3 Justification for Removal from Assessment

The Green Volt Offshore windfarm is located over 75 km from the Scottish coastline and, therefore, well outside the 50 km zone of ZTV as noted within the SNH 2017 guidance. Therefore, no SLIVA is required as part of the EIA and should be removed from the assessment.

The limited onshore export cable installation (marine only – below MHWS) will be of a short duration operation and will utilise similar vessels regularly using the Port of Peterhead (which operates a 24/7 port operation for vessel movements). The presence of a cable lay vessel near to the Port of Peterhead's coastal zone for a short period (days) will result in negligible impact on the coastline SLIVA impacts. As noted in the Hywind and NorthConnect EIA documents, SLIVA was not required for the Hywind cable export or the NorthConnect cable route which are both located in the area of the two proposed Green Volt export routes and no significant issues were noted. Following the installation of the marine export cable there will be no residual SLVIA as the cable will be located beneath the seabed and not observable from any point onshore. Therefore, this has also been removed from the EIA assessment process.

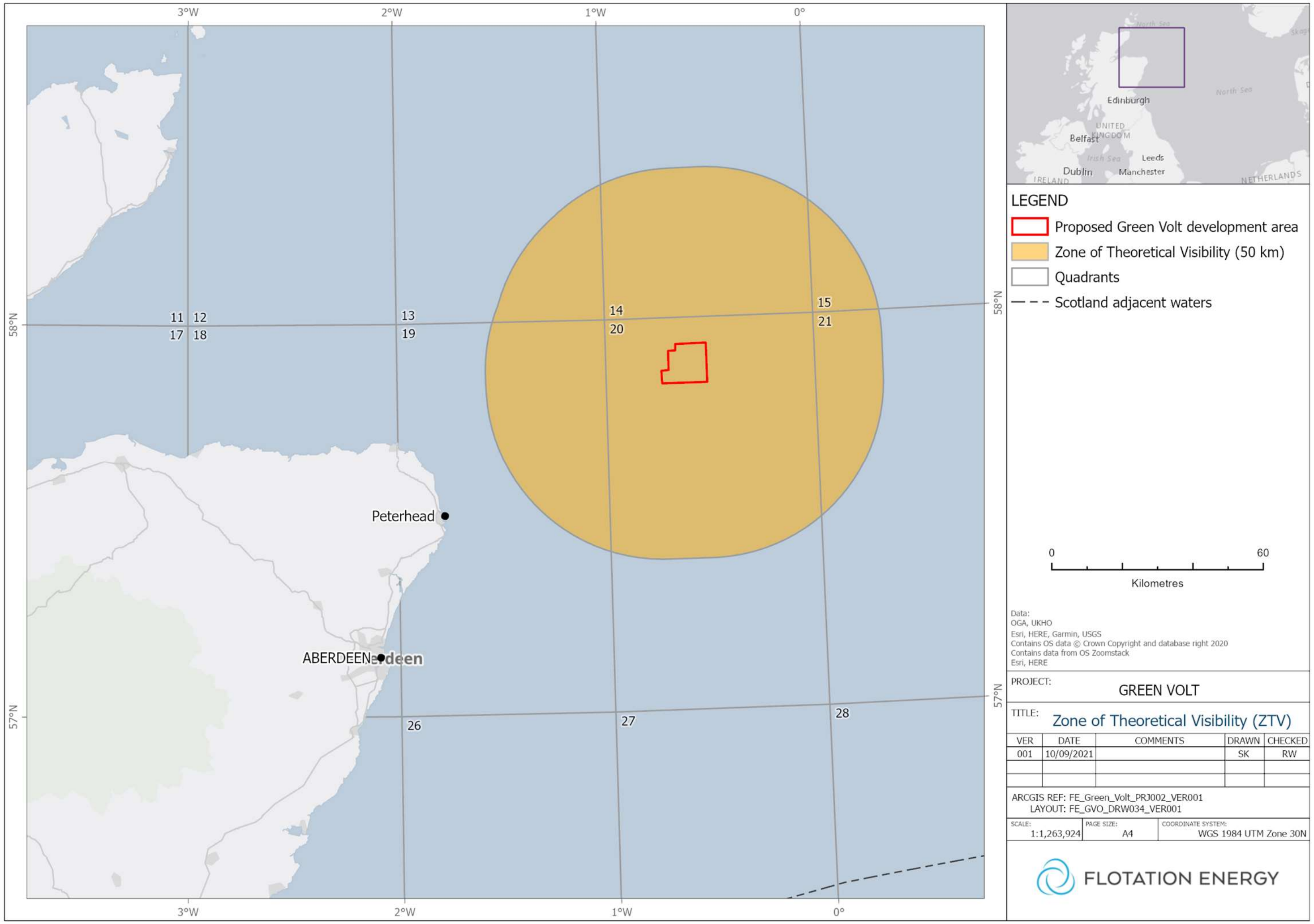


Figure 7.1 50 km zone of theoretical visibility (ZTV) range buffer around Green Volt (as per SNH 2017 guidance)

7.2 Shipping and Navigation

This section was prepared by Anatec Ltd.

This section identifies the elements of the shipping and navigation of relevance for the Green Volt Offshore windfarm and considers the potential impacts across all phases (construction, operation and maintenance, and decommissioning) on shipping and navigation receptors.

As presented in Section 7.2.3, as required the shipping and navigation assessment will follow the relevant Maritime and Coastguard Agency (MCA) guidance, namely Marine Guidance Note (MGN) 654 (MCA, 2021) which requires the production of a Navigation Risk Assessment (NRA). The scoping report therefore sets out additional data, consultation and assessment requirements that will form part of the overarching NRA process.

7.2.1 Data and Information Sources

An initial desk-based review of data sources to support this scoping report has identified the following data sources presented in Table 7.2.

Table 7.2 Baseline Information - Shipping and Navigation

Type / Description of Data	Source	Status
28 days AIS data between 23rd July 2019 – 19th August 2019	Local AIS receivers	Obtained
28 days AIS data between 5th – 18th January 2020 and 4th – 17th February 2020	Local AIS receivers	Obtained
Royal National Lifeboat Institute (RNLI) incident data	RNLI	Obtained – updated data, if available, may be used within the NRA
Marine Accident investigation Branch (MAIB) Incident Data	MAIB	Obtained – updated data, if available, may be used within the NRA
Three years of fishing AIS data between 2018 and 2020	Local AIS receivers	Obtained
NP52 Admiralty Sailing Directions North Coast of Scotland Pilot (United Kingdom Hydrographic Office (UKHO), 2018)	UKHO	Obtained
UKHO Admiralty Chart 278	UKHO	Obtained
Royal Yachting Association (RYA) Coastal Atlas (RYA, 2018)	RYA	To be obtained for NRA

The primary data source considered within this Scoping Report is the 28 days of AIS data which has been used to identify the marine traffic baseline. Admiralty publications including nautical charts have been used to establish the navigational features baseline, and maritime incident data provided by the Marine Accident Investigation Branch (MAIB) and Royal National Lifeboat Institution (RNLI) has been used to determine baseline incident rates.

7.2.2 Existing Environment

7.2.2.1 Navigational Features

This section provides preliminary assessment of navigational features located in proximity to the site. An overview of the identified features is presented in Figure 7.2.

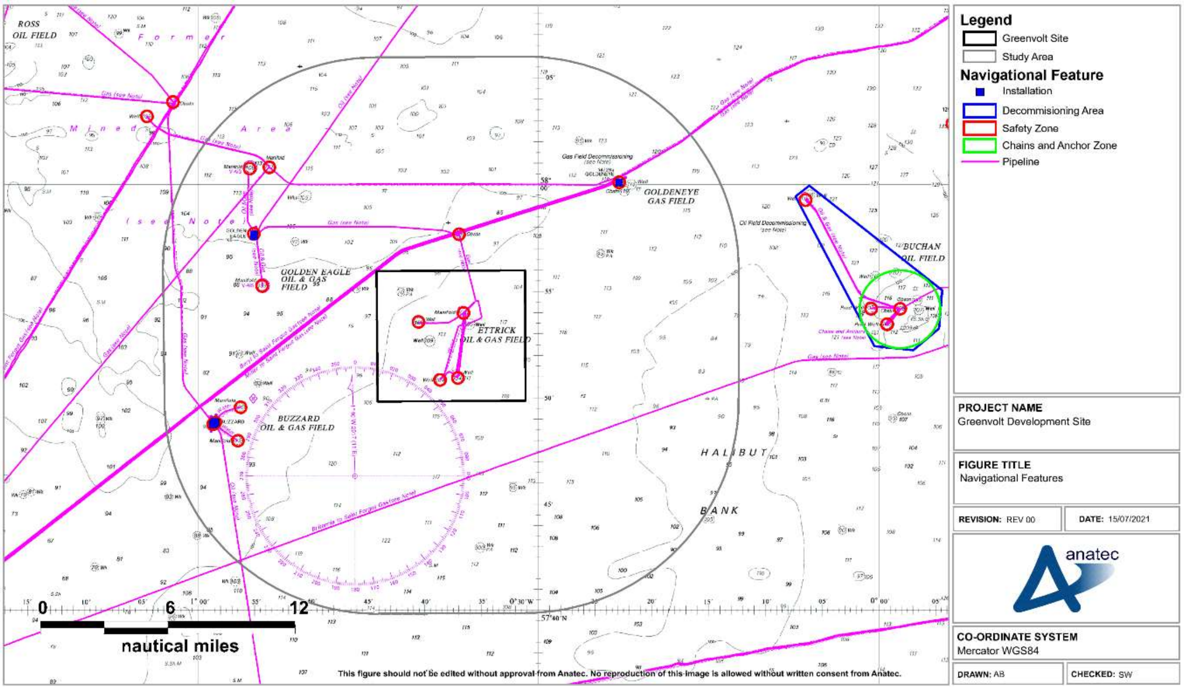


Figure 7.2 Navigational Features

There are four oil and gas fields located within the study area, with various offshore infrastructures located at each field, as detailed in Table 7.3. This includes the Ettrick field which intersects the site boundary, noting that the associated infrastructure has been decommissioned.

A total of 38 active pipelines run through the study area with a number of these running parallel to one another, with one disused pipeline and four pre-commissioned pipelines also present.

Table 7.3 Offshore Infrastructure within the Study Area

Name	Distance (nm)	Manned	Field Type	Phase
Ettrick	0.0	-	-	Decommissioned
Golden Eagle Complex	5.9	Manned	Gas	Operational
Buzzard Complex	7.9	Manned	Oil and Gas	Operational
Golden Eye platform	6.4	Unmanned	Oil and Gas	Assumed decommissioning in 2021

It is noted that planned developments are not considered baseline but will be considered on a cumulative basis within the NRA. This includes the NorthConnect subsea cable which is fully consented in UK waters but is awaiting consent within Norwegian waters. This cable will be installed through the south-east section of site.

7.2.2.2 Marine Traffic

This section provides preliminary assessment of the available marine traffic data sources available at Scoping stage.

The vessels recorded within the study area during the summer 2019 AIS period are presented in Figure 7.3 colour-coded by vessel type. Following this, the vessels recorded within the study area during the winter 2020 survey are presented in Figure 7.4 colour-coded by vessel type. It should be noted that fixed installations including drilling rigs which broadcast on AIS were excluded from the analysis.

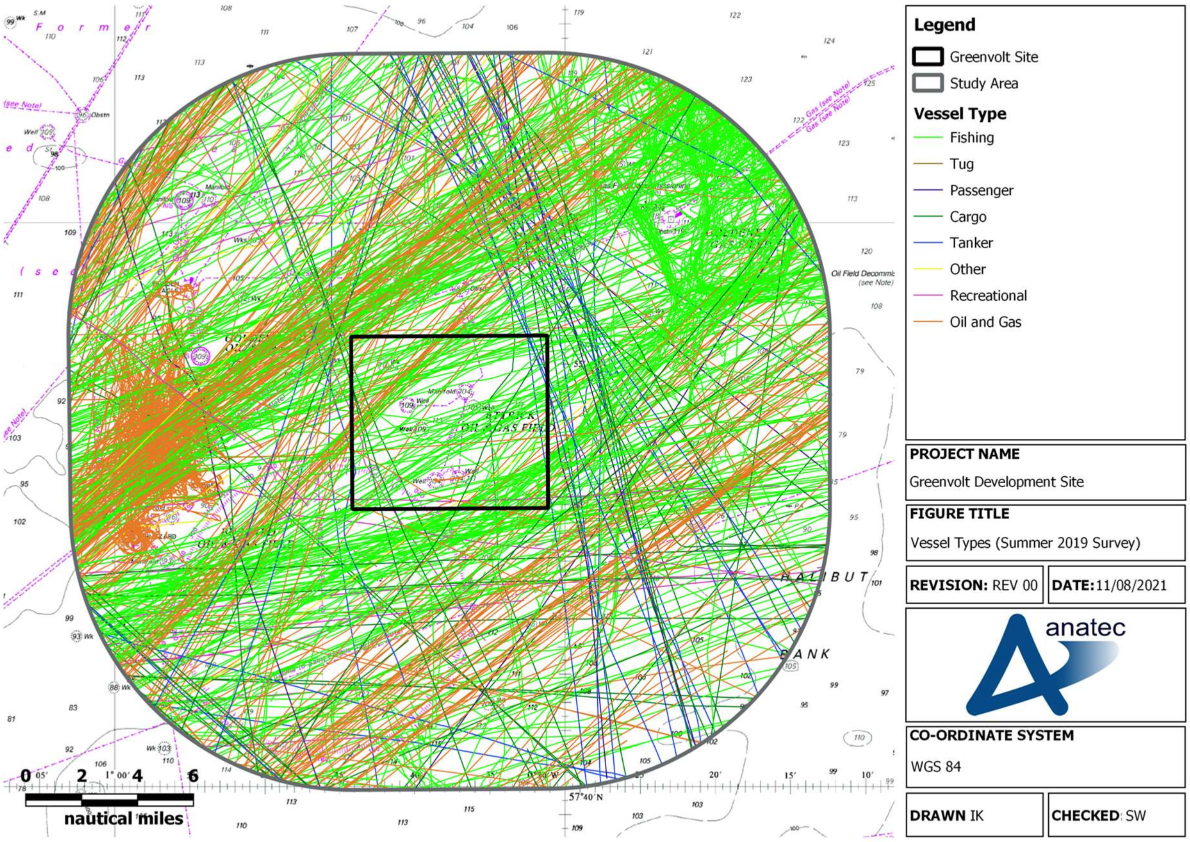


Figure 7.3 Vessel Types (Summer 2019 Survey)

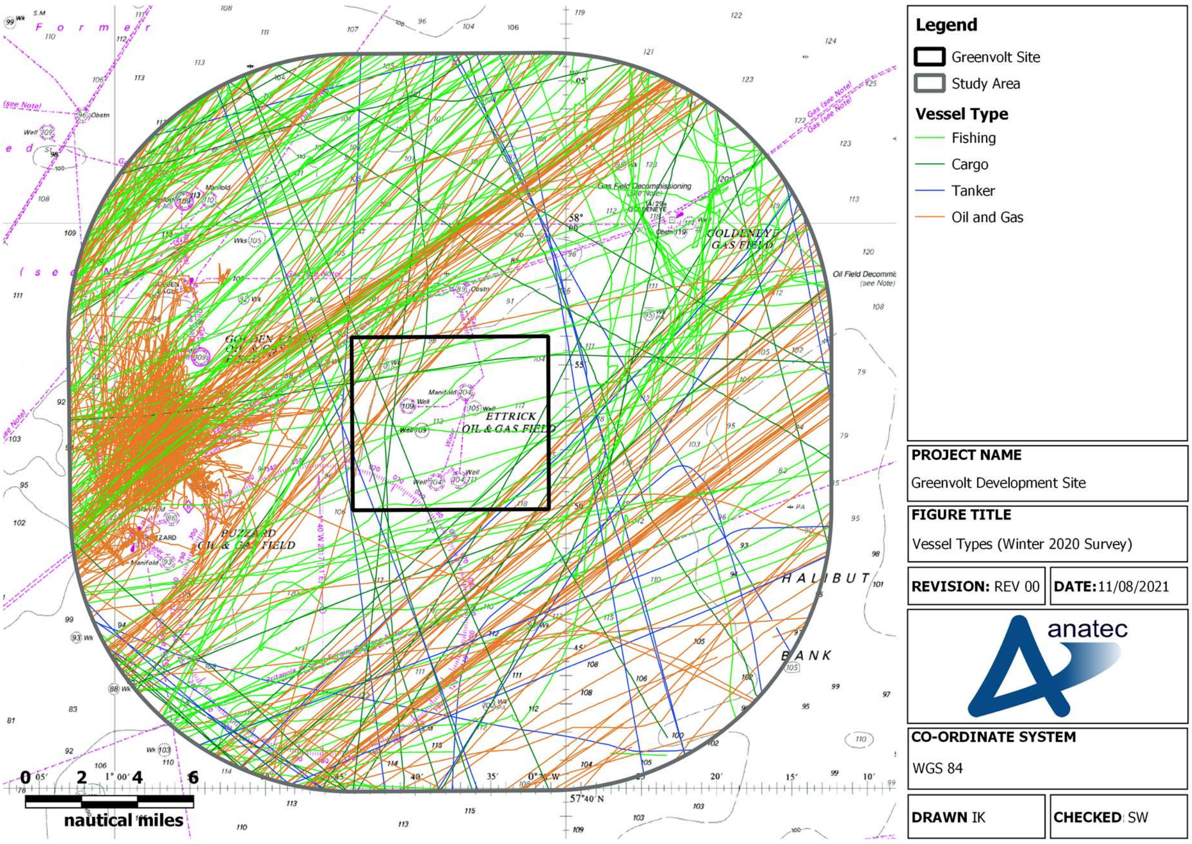


Figure 7.4 Vessel Types (Winter 2020 Survey)

During the summer period, an average of 32 vessels per day were recorded within the study area, and six per day within the site. Activity was less during winter, with an average of 15 vessels per day recorded in the study area, and 2-3 per day within the site. This reduction during winter was observed to be primarily associated with lower levels of fishing activity than during the summer period.

During the summer survey period, the most common vessel types within the study area were fishing vessels (on average approximately 17 per day) and oil and gas vessels (on average approximately five per day). A smaller number of cargo vessels and tanker were also recorded during both survey periods within the study area. During the winter survey period, the most common vessel types within the study area were oil and gas vessels (on average approximately eight per day) and fishing vessels (on average approximately five per day).

Active fishing was observed within the northeast of the study area with the majority of these being demersal trawlers or twin trawlers. Additionally, based on historic data collected from offshore AIS receivers between 2018 and 2020, fishing is also expected in the southeast corner towards the Halibut Bank with this also expected to be mostly demersal and twin trawlers.

Recreational activity was only present during the summer survey period, with an average of one vessel every two days during this period within the study area.

No anchoring activity was recorded within the study area during either survey period, which would be expected given the distance offshore and charted water depths within the study area (minimum 79 m). It is noted that further consideration to anchoring activity relative to the export cable routes will be made within the NRA

7.2.2.3 Maritime Incidents

This section reviews maritime incidents that have occurred in the vicinity of the site based on recent RNLI data and MAIB data. The analysis is intended to provide a general indication as to whether the area of the Green Volt Offshore windfarm is currently low or high-risk area in terms of maritime incidents.

7.2.2.3.1 Marine Accident Investigation Branch

The MAIB incident locations (excluding false alarms and hoaxes) recorded within the study area during the 10-year period between 2010 and 2019 are presented in Figure 7.5 colour coded by incident type.

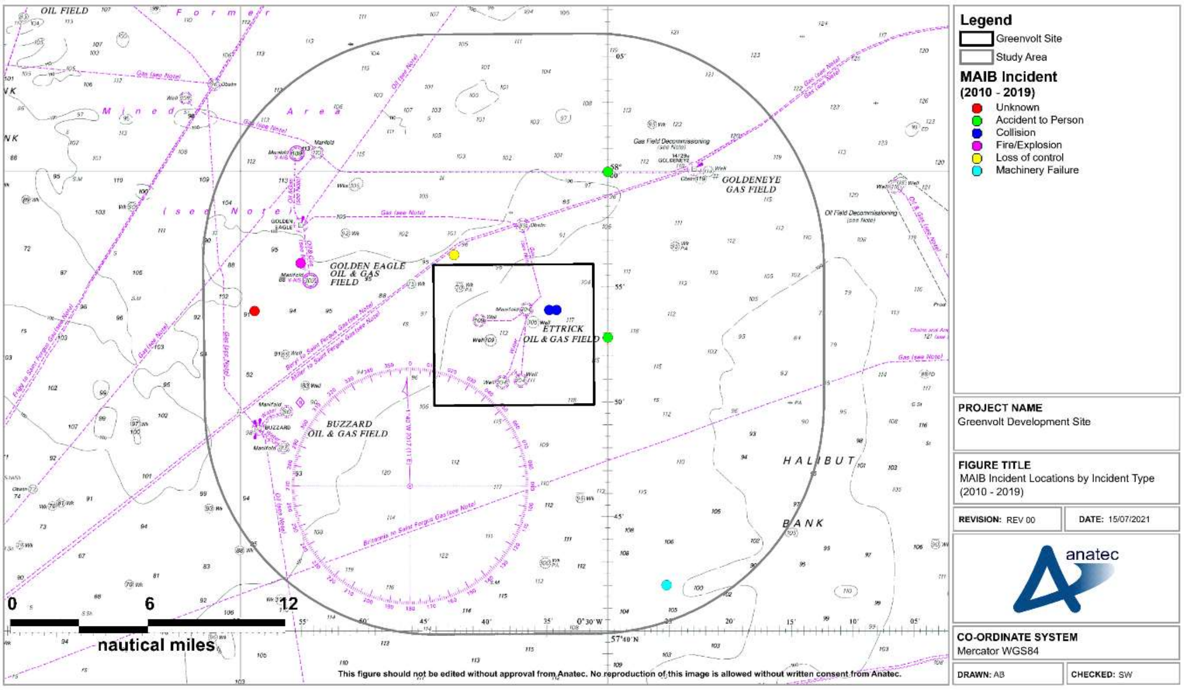


Figure 7.5 MAIB Incident Locations (2010 - 2019)

Over the 10-year period, eight incidents were recorded within the study area based on MAIB data, two of which occurred within the site itself. This was a collision incident between two support vessels that occurred during a man overboard practice exercise. The other six recorded incidents included accident to person, loss of control, fire/ explosion, and machinery failure.

Overall, based on the reported incidents and considering the number of vessels recorded within the study area during the survey periods, the total number of reported incidents is relatively low.

7.2.2.3.2 Royal National Lifeboat Institution

The RNLI incident locations (excluding false alarms and hoaxes) recorded within the study area during the 10-year period between 2010 and 2019 are presented in Figure 7.6colour-coded by incident type.

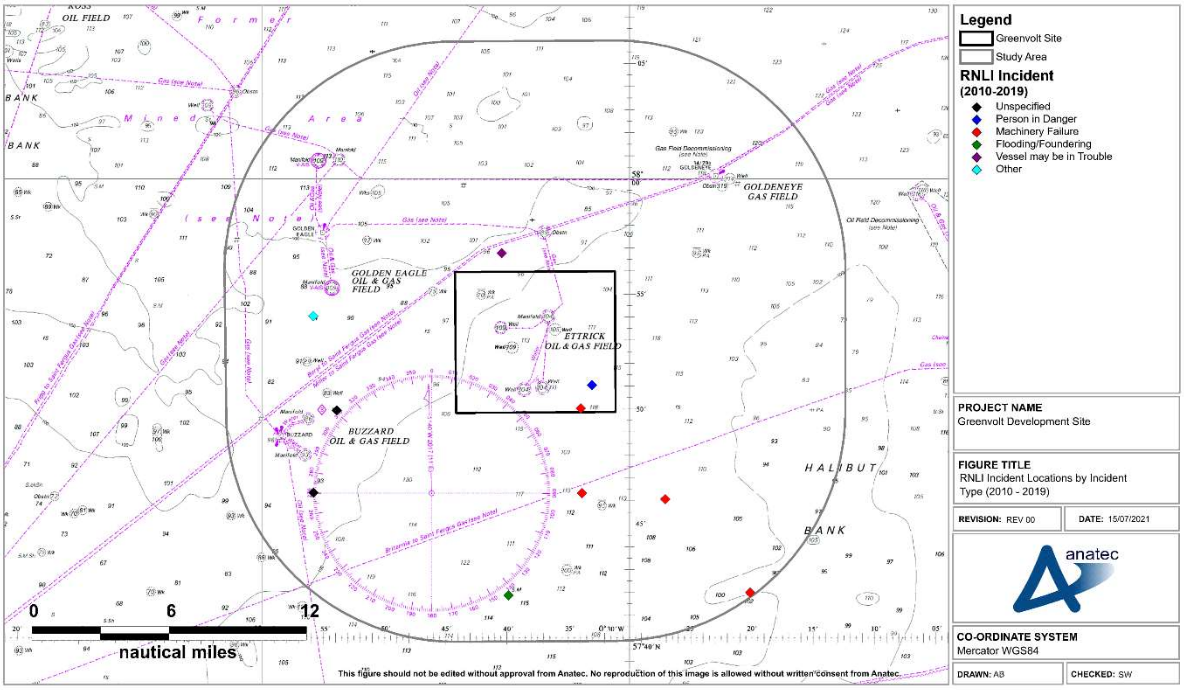


Figure 7.6: RNLI Incident Locations by Incident Type (2010 – 2019)

A total of 10 unique incidents between 2010 and 2019 were reported within the study area. The most frequent incident type was machinery failure (four incidents), followed by unspecified (two incidents). For vessel types, five of the incidents involved fishing vessels and three of the incidents involved recreational vessels.

Two out of the 10 incidents were within the site, these were a person in danger and machinery failure incident.

7.2.2.4 Data Gaps

This scoping report considers 28 days of AIS data, which is considered sufficient to identify the marine traffic baseline for the purposes of the scoping stage. However, this data may underrepresent levels of fishing vessels below 15 m and recreational vessels, as these vessels are not required to broadcast via AIS. Therefore, in line with MGN 654, data collection for the NRA will include radar data to ensure all vessels are captured. This data will be collected using nearby Emergency Response and Rescue Vessels (ERRV) associated with the Golden Eagle and Buzzard platforms. This method was agreed with the MCA in June 2021 given the advantages of crew familiarity with the area and regular users and to allow longer term data collection given commercial fishing activity in the area.

7.2.3 Potential Impacts

Potential impacts relating to the potential changes to the shipping and navigation of the area are considered in Section 7.2.3.1 below. It is noted that the impacts identified will also be considered for the potential of cumulative impact within the NRA and assessed at EIA level where appropriate.

It is noted that impacts associated with commercial fishing gear are outside of the scope of the NRA and are considered within Section 7.3.

7.2.3.1 Potential Impacts

A range of potential impacts on shipping and navigation have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Green Volt Offshore windfarm. The impacts that have been scoped into the assessment are outlined in Table 7.4.

Table 7.4 Summary of potential impacts to shipping and navigation (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Displacement of vessels	✓	✓	✓
Encounters and vessel to vessel collision	✓	✓	✓
Allision risk	✓	✓	✓
Snagging risk (anchored vessels)	✓	✓	✓
Loss of WTG(s)	✓	✓	✓
Reduced under keel clearance	✓	✓	✓
Reduced Search and Rescue (SAR) capabilities	✓	✓	✓
Navigation, communication, and position fixing equipment	✓	✓	✓
Electromagnetic interference from export cables	✓	✓	✓

7.2.3.2 Potential Cumulative Impacts

There is potential for cumulative effects to occur on shipping and navigation users as a result of other projects or activities.

The cumulative assessment will consider the maximum adverse scenarios for the projects.

Offshore windfarms and any other relevant marine activity within the 50 nm regional shipping and navigation study area will be considered in the cumulative assessment.

Where relevant, impacts assessed within the NRA process for the development in isolation will also be assessed for a cumulative impact.

7.2.3.3 Transboundary Impacts

A screening of transboundary impacts will be carried out. The screening exercise will identify if there is the potential for transboundary impacts upon shipping and navigation due to the Green Volt Offshore windfarm. Specifically, transits to/from other countries including effects on shipping routes to/from transboundary ports may lead to impacts

7.2.3.4 Mitigation

The following embedded mitigations have been considered when considering potential significance of an impact:

- Compliance with MGN 654 (MCA, 2021) and its annexes where applicable;
- Appropriate marking on Admiralty charts;
- Promulgation of information as required (e.g. Notice to Mariners, Kingfisher Bulletin);
- Buoyed construction area in agreement with Northern Lighthouse Board (NLB);
- Application for safety zones of up to 500 m during construction and periods of major maintenance;
- Marine coordination and communication to manage project vessel movements;

- Marking and lighting of the site in agreement with NLB and in line with IALA Recommendation O-139 (IALA, 2013);
- Production of a Marine Pollution Contingency Plan;
- Compliance with regulatory expectations on moorings for floating wind and marine devices (HSE/MCA 2017);
- Cable installation and operation risk assessment;
- Blade clearance of at least 22 m above MHWS; and
- Guard vessel(s) as required by risk assessment.

7.2.4 Approach to Impact Assessment

7.2.4.1 Consultation

In order to inform the shipping and navigation EIA, consultation during the pre-application phase is planned with the following statutory and non-statutory organisations, noting other organisations as identified may also be consulted:

- MCA;
- NLB;
- UK Chamber of Shipping;
- Royal Yachting Association (RYA) Scotland;
- Cruising Association;
- Scottish Fishermen's Federation (SFF); and
- Regular commercial operators, including those operating oil and gas support services.

A hazard workshop will also be held with regular operators, local port operators, and statutory stakeholders as part of the NRA process (noting this is an MGN 654 requirement). Relevant fishing industry representatives will also be invited to attend.

7.2.4.2 Study Area

It is proposed that data assessment be primarily undertaken within a 10 nm buffer of the site (the 'study area'), as presented in Figure 7.7. This radius is standard for shipping and navigation assessments as it is typically large enough to capture relevant navigational features and passing marine traffic whilst remaining site specific to the project being studied. It is noted that assessment may extend beyond the 10 nm threshold where appropriate within the NRA process.

The NRA will also assess a 2 nm buffer of the offshore export cable corridor.

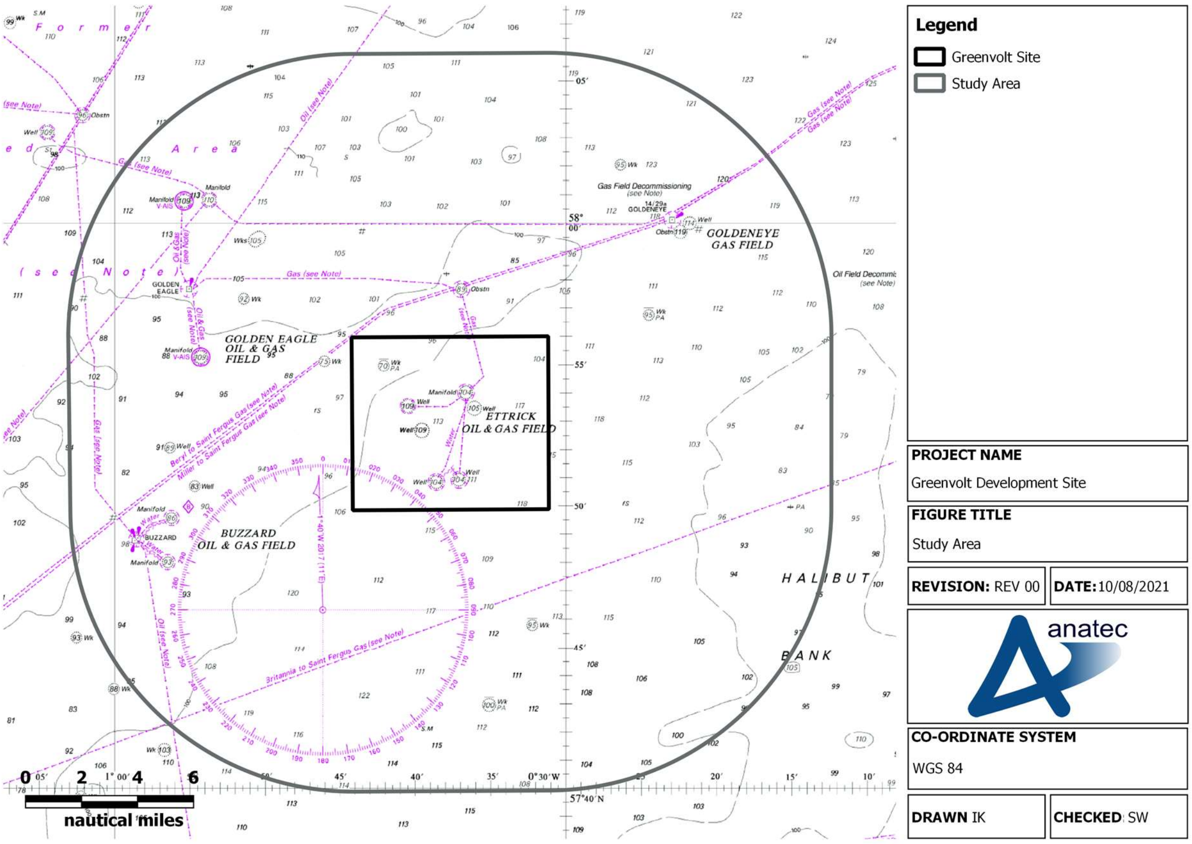


Figure 7.7: Study Area

7.2.4.2.1 Impact Assessment Methodology for Shipping and Navigation

The shipping and navigation offshore Environmental Impact Assessment (EIA) Report will follow the methodology set out in the following guidance documents:

- Marine Guidance Note (MGN) 654 Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Responses and its Annexes (Maritime and Coastguard Agency (MCA), 2021);
- IMO guidelines for Formal Safety Assessment (FSA) (IMO, 2018);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2013);
- MGN 372 Offshore Renewable Energy Installations (OREIs) – Guidance to Mariners Operating in the Vicinity of United Kingdom (UK) OREIs (MCA, 2008);
- The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy (RYA, 2019); and
- MCA and Health & Safety Executive (HSE) Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA & HSE, 2017).

As per the methodology stated in the MCA methodology (Annex 1 to MGN 654) (MCA, 2021), an NRA should be undertaken where impacts will be assessed on a preliminary basis to identify the impacts that should be included within the EIA. Given that the NRA includes a set of criteria under MGN 654 (MCA, 2021) which must be considered, no impact will be scoped out at this scoping stage i.e., all impacts will be considered within the NRA process.

The IMO FSA Methodology (IMO, 2018) is the internationally recognised approach for assessing impacts to shipping and navigation receptors, and is the approach required under MGN 654 (MCA, 2021). It is noted that this methodology differs to that used in the other chapters, however it is the methodology required by the relevant regulatory bodies. This methodology is centred on risk control and assesses each impact in terms of its frequency and consequence in order that its significance can be determined as "broadly acceptable", "tolerable", or "unacceptable". Any impact assessed as "unacceptable" will require additional environmental measures implemented beyond those considered embedded to reduce the impact to within "tolerable" or "broadly acceptable" parameters.

The frequency and consequence of each impact will be assessed, with significance then determined via a risk matrix approach (Table 7.5). This process will consider a number of inputs, including:

- Quantitative modelling (Anatec's CollRisk software);
- Output of the baseline assessment including vessel traffic surveys;
- Consideration of embedded environmental measures in place;
- Lessons learnt from other offshore windfarm projects;
- Level of stakeholder concern; and
- Outputs of consultation.

Table 7.5 Risk Matrix

Frequency						
	Frequent	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
	Reasonably Probable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
	Remote	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
		Negligible	Minor	Moderate	Serious	Major
	Severity					

7.2.4.3 Proposed Additional Survey Requirements

In addition to the data sources listed in Section 7.2.1, the following additional data sets presented in Table 7.6 will be required.

Table 7.6 Additional Survey Data Required

Dataset	Justification
28 days of seasonal AIS, Radar, and visual observations within the study area	Compliance with MGN 654
28 days of seasonal AIS data covering offshore export cable corridor study area	Assessment of risks associated with the export cables (e.g., anchor interaction, under keel clearance)

7.3 Commercial Fisheries

7.3.1 Data and Information Sources

As part of the wider engagement process with the commercial fishing community and to help support the wider data and information gathering requirements for the Project, Green Volt has engaged a suitably qualified Fishing Liaison Officer (FLO) to support the project moving forward and also to liaise with the wider fishing community on behalf of the project. Any additional information gathered by the FLO will be added to the initial data gather as noted below.

The following baseline data have been collected from the sources listed in Table 7.7.

Table 7.7 Baseline information – commercial fisheries

Type/description of data	Source	Status
Fisheries landings (tonnes), landings value (GBP) and effort data by ICES rectangle 2015 - 2019	Marine Management Organisation (MMO)	Obtained
Vessel Monitoring System (VMS) data 2015 - 2019	MMO	Obtained
Vessel Monitoring System (VMS) data 2009 - 2020	Marine Scotland (2020 data is provisional)	Obtained
Fisheries datasets available from the Marine Scotland MAPS nmPi (including ScotMap data)	https://marine.gov.scot/maps/nmpi and https://marinescotland.atkinsgeospatial.com/nmpi/	Obtained
NorthConnect HVDC Cable Infrastructure EIA Report	Chapter 20: Commercial Fisheries	Obtained

7.3.2 Existing Environment

An indication of the principal fishing activities undertaken within the commercial fisheries study areas is provided below, based on analysis of landings (tonnes) and landings value (GBP) by species and fishing method for UK vessels (annual average 2015 to 2019).

7.3.2.1 Existing Commercial Fisheries

Fishing takes place throughout the year across the three ICES rectangles that cover the study area with peaks in landings during summer and early autumn. Within 44E9 landings are highest during the summer months with a smaller peak in January and February. Landings in 44E8 are relatively consistent throughout the year although highest between May and October and in 43E8 landings are highest between late spring and early autumn.

Figure 7.8 provides a breakdown of the average value of landings by species. In rectangle 44E9 the highest average annual value of landings was of Nephrops and haddock, followed by monkfish. In 44E8 the highest average annual value of landings was for crabs and scallops, followed by Nephrops and haddock. In 43E8 the highest average annual landings were for scallops. Other high value species in 43E8 include herring, crabs and lobsters.

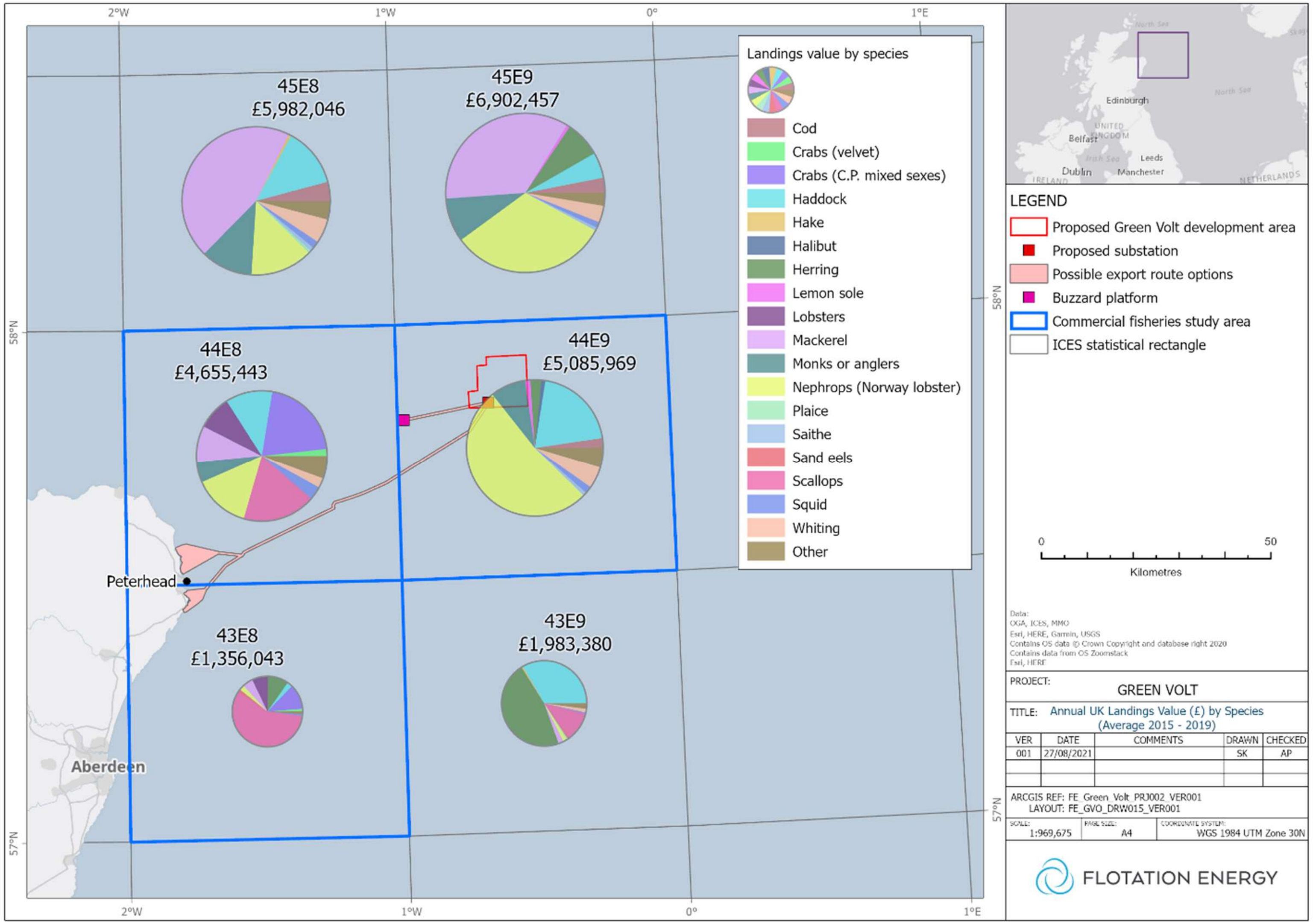


Figure 7.8 Average Value of Fisheries Landings (GBP) by Species 2015-2019

Within ICES rectangle 44E9 landings (tonnes) of haddock, Nephrops, herring, whiting and monkfish by demersal trawlers (including bottom trawls, otter trawls, twin-rig trawls, pair trawls and Scottish seines) make up most landings. In rectangle 44E8, inshore of 44E9, haddock landed by demersal trawlers is the main species, followed by crabs from potting and scallops from dredging. Other key species from these rectangles include cod, squid, halibut, mackerel, lobsters and lemon sole. The export cable route also extends into rectangle 43E8 where landings are dominated by herring from demersal trawling and scallops from dredging activity. Other key species include crabs and lobsters from pots and sand eels and mackerel from demersal trawlers.

The total value of fisheries in the Project Area and along the potential export cable route between 2015 and 2019 is dominated by demersal trawls, with total value of catches between 2015 and 2019 of £25.4 million in 44E9 (annual average of £5.1 million), £10.5 million in 44E8 (annual average of £2.1 million) and £1.2 million in 43E8 (annual average of £247,369). Dredging realised total value of catches between 2015 and 2019 of £37,790 in 44E9 (annual average of £12,597), £4.2 million in 44E8 (annual average of £843,485) and £3.9 million in 43E8 (annual average of £784,498). The total value of potting landings between 2015 and 2019 in 44E9 was £2,679 all landed in 2017. In 44E8 the total value between 2015 and 2019 was significantly higher at £7.2 million (annual average of £1.4 million) and in 43E8 was £1.3 million (annual average of £267,156), demonstrating the inshore nature of these gears. Gears using hooks (e.g. handlines) had the highest total value of landings between 2015 and 2019 of £1.3 million in 44E8 (annual average of £265,513), followed by 43E8 at £285,102 (annual average of £57,020). Total landings in 44E9 were less than £500 during the five-year period between 2015 and 2019. This distribution of the value of landings by different gear types is shown in Figure 7.9.

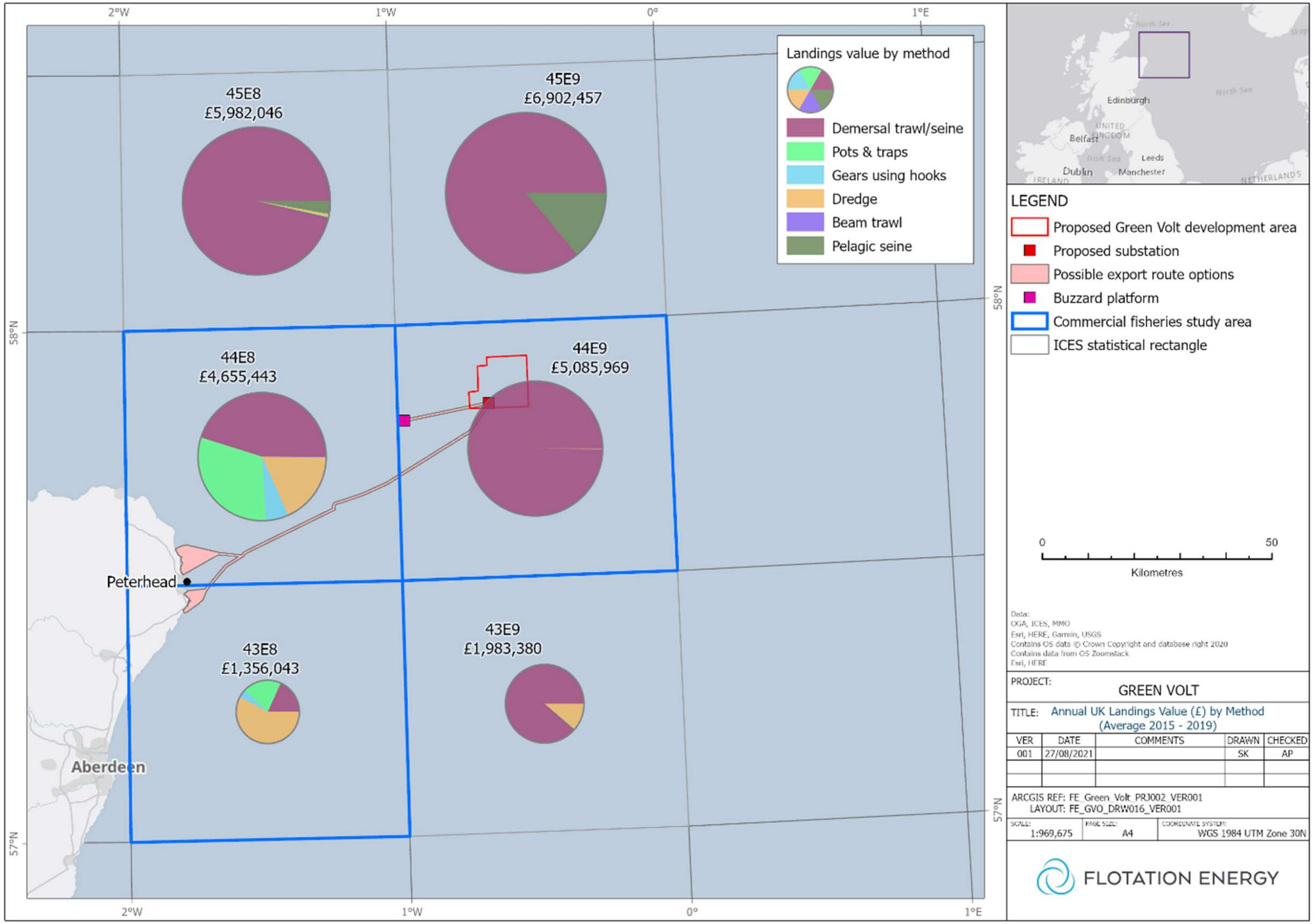


Figure 7.9 Value of Fisheries Landings (GBP) by Gear Type

ScotMap data (Kafas *et al.,* 2014) indicates fishing activity within close proximity of the cable route and potential landfall sites. Kafas *et al.,* (2014) indicates that the majority of creeling activity occurs within 3 nm, although some vessels operate as far out as 6 nm with few operating beyond 6 nm and no creeling activity beyond 12 nm. Although the ScotMap data was collected several years ago, feedback during consultation for the NorthConnect project (NorthConnect, 2018) suggests that this pattern was still in place in 2018. The ScotMap data also shows that the potential landfalls and inshore cable route mainly crosses areas where creel boats operate, with scallop dredgers operating more to the south and north of the area. The crab and lobster fishery is the highest value fishing activity by the inshore fleet of <10 m length vessels (Scottish Government, 2020). There is also a significant hand-line fishery for mackerel between May and November. An estimated 45 vessels are understood to target the fishery from Peterhead, with a declining number of vessels further from the coast (based on Kafas *et al.,* 2014). Hand lining also includes the automated lines used to target mackerel known as jigging machines. Mackerel grounds are variable from year to year and vessels will operate wherever the mackerel are most abundant.

Vessel Monitoring Systems (VMS) datasets demonstrate very low levels of fishing effort within the Project Area. Figure 7.10 shows VMS data from 2015 and 2019 and demonstrates minimal fishing effort within the Green Volt Project Area. Other than the southeast corner, average effort across the site is less than 50 hours compared to areas directly south of the site that show more than double the fishing effort, with an average of 100 – 200 hours. Along the possible export route options, there are areas of relatively high fishing effort, particularly to the immediate southwest of the Green Volt Project Area and close to shore where dredging activity is higher. However, there are areas where fishing activity is very low with on average less than 10 hours of effort over the period between 2015 and 2019.

Figure 7.11 shows data plotted from a AIS survey conducted in summer 2019 and winter 2020, which further corroborates the conclusion that the area experiences extremely low fishing effort and is not of significant importance to the fishing industry. Review of monthly AIS data collected from offshore AIS receivers for 2018 to 2020 shows a similar pattern (Anatec, 2021), with very few vessels (less than 20 a month) actively fishing across the Project Area. Other than a portion of the southeast corner of the Project Area which shows higher density fishing activity, vessels generally only transit the area. Should this southeast corner be removed from the Project Area boundary, this results in a 40% reduction in the number of vessels actively fishing across the site. The key reason for the lack of fishing area is likely to be the presence of oil and gas infrastructure on the sea surface and on the seabed, although fishing has not increased since the removal of the Ettrick FPSO.

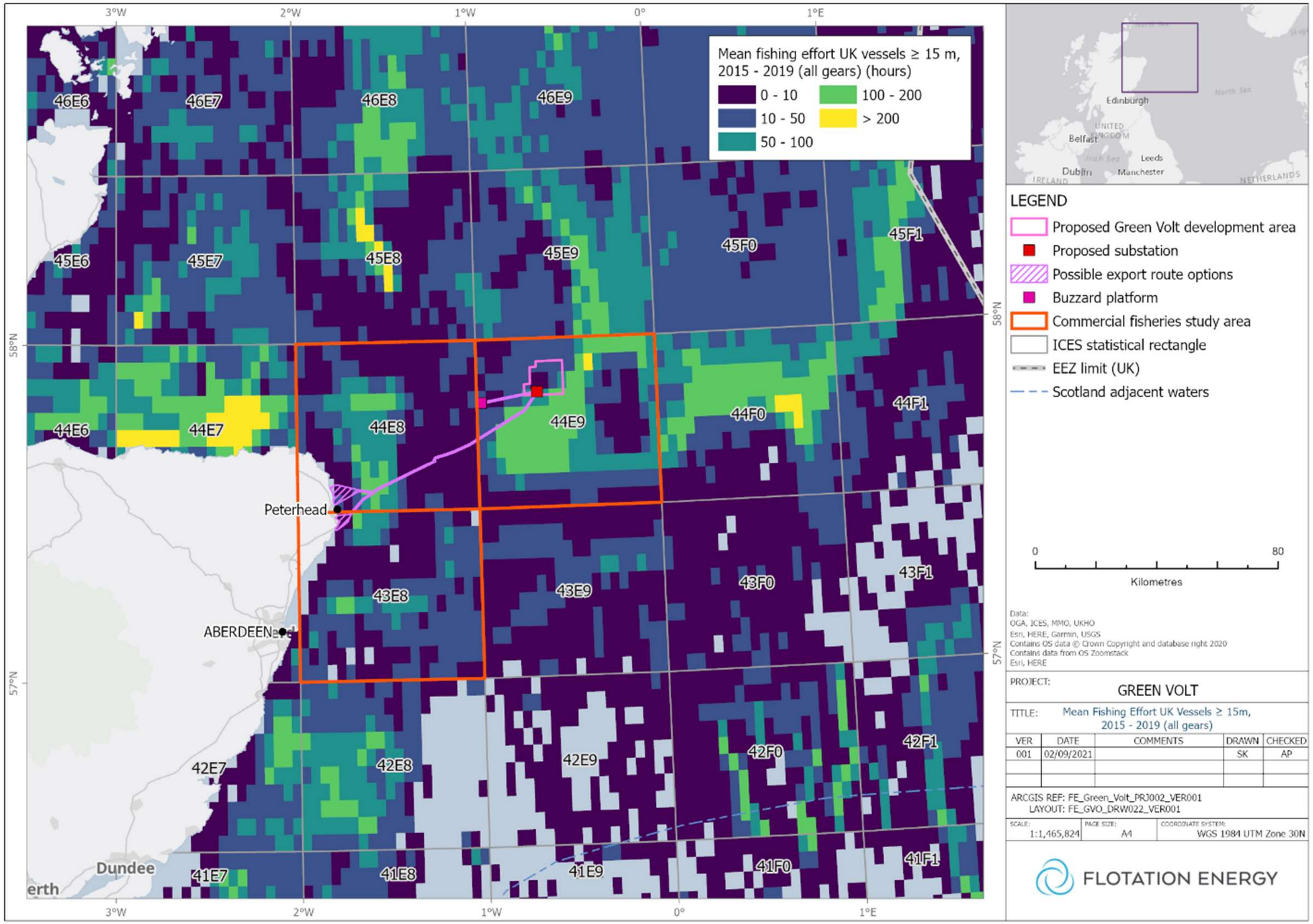


Figure 7.10 VMS Data Showing Mean Fishing Effort Between 2015 and 2019 (source: MMO)

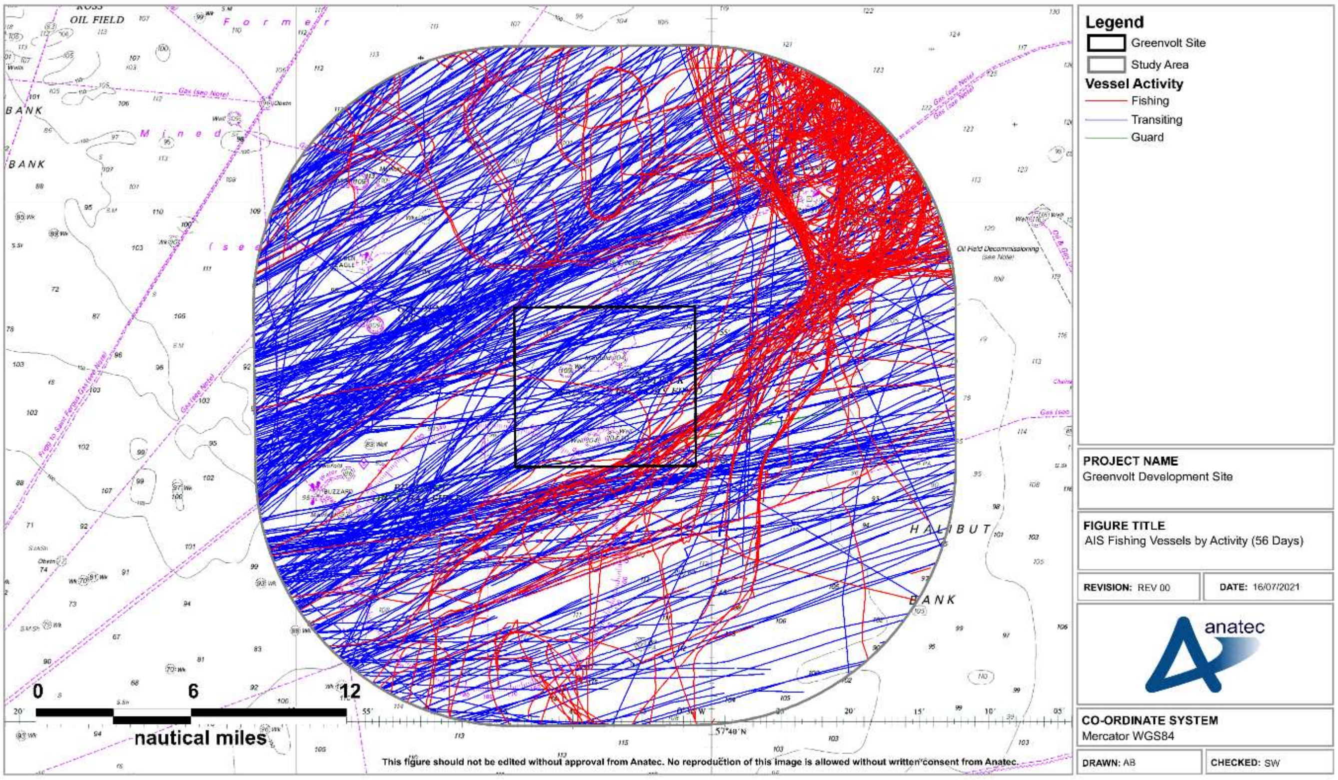


Figure 7.11 AIS Fishing Vessels by Activity (56 Days

In summary, fishing activity in the ICES rectangles surrounding the project (including potential export cable route and landfall) is important for both < 10 m and > 10 m fishing fleets. Offshore, landings are generally dominated by Nephrops and haddock targeted using demersal trawls, with crabs and lobsters targeted using pots and scallops using dredges becoming more important in inshore waters. Inshore waters also see catches taken by gears using hooks, mainly seasonal handlining for mackerel but also catching plaice, cod, pollack and squid. While the regional picture is of a very active and valuable fishery, VMS and AIS data across the site demonstrate the location has virtually no fishing activity, with only one errant vessel shown to cross the area while fishing during the summer and winter AIS surveys (see Figure 7.11), with only the southwest corner of the site utilised to any degree. It should be noted that the FPSO was removed in 2017 and AIS data recorded from 2018 to 2020 continues to show very low fishing activity. As turbine installation will not occur within the southeast corner, it is unlikely that there will be significant overlap with fishing activity and the Project Area.

7.3.2.2 Salmon and Trout Fisheries

Atlantic salmon and sea trout are diadromous or migratory species of fish, with a lifecycle that includes time in freshwater river environments and at sea. After a period spent in a riverine environment, the individuals undertake a marine migration to offshore feeding grounds, returning after a varying number of years to their natal river to spawn (see Section 6.2). It is probable that they will transit the cable route corridor, close to the landfall and potentially the Project Area. Therefore, migration behaviour and subsequently catch levels could potentially be disrupted.

Each fishery in Scotland is required to provide the number and total weight of salmon and grilse (adult salmon returning after only 1 year at sea) and sea trout caught and retained each month of the fishing season. The principal salmon and sea trout fisheries are rod and line (including catch and release), fixed engine (bag netting) and net and coble.

The cable landfall is located in the North-East region and is bordered by a number of District Salmon Fishery Boards (DSFB), including Esk, Dee, Don, Ythan and Ugie, Deveron and Spey. The potential cable landfall is within the River Ugie DSFB.

Rod and line gears dominate with the greatest proportion of caught fish subsequently being released. The rod and line salmon fishery can be subdivided into 'catch and release' and 'catch and retain' activities. Catch and release activities dominate salmon and sea trout fishing activities, comprising 55% of all fish caught in the north-east region. The net and coble fisheries typically operate between May and August and the rod and line (retained) fishery operate between April and October. The rod and line (released) fishery has the longest operational period, occurring from February to October in 2019. No salmon or sea trout were caught between December 2019 and January 2020 (Scottish Government, 2020).

7.3.2.3 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

7.3.3 Potential Impacts

Possible impacts on commercial fisheries receptors within the Green Volt Project Area and proposed cable corridor are considered in Table 7.8.

Table 7.8 Summary of potential impacts to commercial fisheries (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Reduction in access to, or exclusion from established fishing grounds (Windfarm Site).	x	x	x
Reduction in access to, or exclusion from, established fishing grounds (export cable route)	x	x	x
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds (Windfarm Site)	x	x	x
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds (export cable route)	x	x	x
Displacement or disruption of commercially important fish and	x	x	x

shellfish resources (Windfarm Site)			
Displacement or disruption of commercially important fish and shellfish resources (export cable route)	x	x	x
Construction activities leading to additional steaming to alternative fishing grounds (Windfarm Site)	x	x	x
Construction activities leading to additional steaming to alternative fishing grounds (export cable route)	x	x	x
Physical presence offshore windfarm infrastructure leading to gear snagging (Windfarm Site)	x	x	x
Increased vessel traffic within fishing grounds leading to interference with fishing activity (Windfarm Site)	x	x	x
Increased vessel traffic within fishing grounds leading to interference with fishing activity (export cable route)	x	x	x

7.3.4 Approach to Impact Assessment

The potential for effects on commercial fisheries arises from the physical existence of the windfarm and windfarm infrastructure and the construction methods adopted. As a floating offshore structure will have a larger seabed footprint than a traditional offshore wind turbine structure due to the presence of mooring lines and anchors the space usage by the windfarm is likely to be increased.

The potential impact on commercial fisheries during construction and operation is significantly reduced due to a lack of fishing effort within the offshore windfarm array due to the historic presence of oil and gas infrastructure. Therefore, existing fishing effort is minimal.

7.3.4.1 Proposed Additional Survey Requirements

No site-specific surveys have been undertaken to inform the Scoping and commercial fisheries surveys are not planned as part of the baseline data collection process. However, consultation with fisheries stakeholders is planned to be undertaken to support the commercial fisheries baseline data collection within the EIA process, to ground truth the data collection and to ensure all available data has been gathered.

Site-specific surveys undertaken for other topics (e.g. benthic ecology (Section 6.1) and shipping and navigation (Section 7.2) may yield relevant data for commercial fisheries (e.g. on commercial shellfish and fish species) and will be integrated into commercial fisheries baseline as appropriate.

7.3.4.2 Data and Information Gaps

VMS provides commercial catch statistics (landings value, tonnage and effort) for vessels > 15 m length with vessels >12 m in length also being captured in more recent datasets. Plans are also in place to add VMS for vessels between 10 and 12 m in length. The MMO / Marine Scotland present these data in an ICES sub-rectangle grid system (3 x 1.75 nm) to provide geographical context for interpretation. It should be noted that fishing will not occur in a uniform fashion throughout the area of an ICES rectangle and may vary between rectangles. Fishing activity also varies both seasonally and annually. In order to take account of this fact, data is averaged over a five-year period (2016-2020). Due to the processing required for these data there is a lag before the data is available for use therefore the most recent VMS data used in this study is from 2020. It should be noted that at this stage the 2020 VMS data set is provisional and is subject to change.

Like VMS, ScotMap data has also been presented as a grid system. These data are based on interviews with the inshore fleet (representing < 15 m vessel length). ScotMap provides the best available data for the inshore area but notable gaps include:

- Not all vessels have been interviewed;
- Earnings information was not always available;
- The way some fishermen have defined their fishing areas affected the output resolution of the maps, dispersing value and giving a false impression of where some types of fishing are taking place; and
- The study took place in 2013 and has not been updated. Therefore, some of the information presented may be out of date.

7.3.4.3 Justification for Removal from Assessment

A review of the potential impacts on commercial fisheries from the development have identified differences in the potential for significant impacts to occur between the Green Volt Project Area and the potential export cable route. The Green Volt Project Area, other than a small portion in the southeast corner, is rarely fished and represents an area of insignificant fishing effort, especially when compared to other areas in close proximity. This has continued to be the case even since the removal of the Ettrick FPSO. VMS data between 2015 and 2019 and AIS data from 2018 to 2020 continues to show very low levels of fishing activity. The south-eastern corner does show some significant fishing effort. However, removal of this area reduces any interactions by 40% and the Green Volt Project Area will be reduced in order to ensure the offshore infrastructure is not constructed in the area, further reducing any potential interactions. As a result, it is very unlikely that there will be any significant impacts on fishing activity within the Project Area and, therefore, impacts to commercial fisheries are scoped out of the assessment. In contrast fishing activity occurs across the export cable route and, therefore, impacts to commercial fisheries have the potential to occur and are scoped into the assessment.

7.4 Marine Archaeology and Cultural Heritage

This section was produced by Royal HaskoningDHV.

7.4.1 Data and Information Sources

This section has been prepared through a high-level review of the following sources:

- United Kingdom Hydrographic Office (UKHO)
- Maritime records maintained by CANMORE (National Record of the Historic Environment)
- Marine Scotland's Historic Marine Protected Areas (HMPAs) online viewer
- Scottish Archaeological Research Framework (ScARF)
- Relevant information from the Ettrick and Blackbird oilfields and NorthConnect Interconnector ES's and EIA's

The marine archaeology and cultural heritage assessment will include all receptors within the scoping area (array area, offshore cable corridor, north of Peterhead cable corridor and South of Peterhead cable corridor) seawards of MHWS. This will include any receptors in the intertidal zone.

The data sources that will be accessed to characterise the existing historic environment for EIA with respect to offshore archaeology and cultural heritage are set out in Table 7.9.

Table 7.9 Site-specific data sources

Data source	Data contents
United Kingdom Hydrographic Office (UKHO)	Records of wrecks and obstructions data including 'dead' and salvaged wrecks that are no longer charted as navigational hazards.
Maritime records maintained by CANMORE (National Record of the Historic Environment)	Maritime records, including documented losses of vessels, and records of terrestrial monuments and findspots, including the archaeological excavation index.
Historic Environment Scotland	Records of designated heritage assets within Scotland, maintained by Historic Environment Scotland. GIS data for all Protected Wrecks, Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and Registered Battlefields.
Aberdeenshire Historic Environment Record (HER)	Contains data on all recorded non-designated heritage assets, held by Aberdeenshire Council. The data includes archaeological, historic landscape and historic building information. Information on previous events (archaeological surveys and investigations) will also be obtained.
British Geological Survey (BGS)	Historic borehole logs and the wider geological background for the region.
Regional Seascape Assessments	Character texts for seascape character of coastal and marine areas around Scotland.
Scottish Archaeological Research Framework (ScARF)	The primary resource for Scottish archaeology, one which provides an overview of the subject and also a set of relevant research questions to guide assessment.
Existing archaeological studies and published sources	Background information on the archaeology of the North Sea, including the results of nearby offshore windfarm projects including NorthConnect Interconnector and the Ettrick and Blackbird oil and gas works.

Multi Beam Echosounder (MBES), Sub Bottom Profiler (SBP) and Magnetometer (MAG) data was collected for the NorthConnect projects and the Ettrick and Blackbird oil fields.

Additionally, in 2021, as part of the Ettrick and Blackbird decommissioning requirements and to support the future Green Volt project a full site survey using Sidescan Sonar (SSS), MBES, SBP (Pinger) and

MAG was undertaken to identify any oil and gas related debris and to support the Green Volt assessment process. (Gardline, 2021)

MBES and SSS was collected during this 2021 survey from the export cable routes from Green Volt to the Buzzard platform and also adjacent to the NorthConnect cable corridor back to the 12 m boundary. This data and the data collected as part of the Ettrick and Blackbird decommissioning requirements can be made available to a suitably experienced, specialised archaeological contractor for assessment and reporting to inform the archaeological assessment for the Green Volt Offshore windfarm.

7.4.2 Existing Environment

At various times in the past the North Sea has been exposed as dry land including the development site which was dry land until sometime after c.16,000 BC (World Ocean Review, 2017). This is due to sea level falls driven by climate change. Buried sediments related to this may contain, not only direct archaeological evidence of the human occupation of the area, but also palaeo-environmental data. This can be used to develop an understanding of the wider natural environment within which early humans lived.

A range of Palaeolithic stone artefacts as well as Pleistocene faunal remains have been recovered in the North Sea. However, these have largely been found further south, from the Brown Ridge area and Dogger Bank, with the Scottish assemblage limited to two worked flints. One of these was obtained from a vibrocore (number 60+01/46) acquired as part of a BGS programme on the UK shelf, some 150 km north-east off Lerwick, near Viking bank further north of the development site (ScARF, 2012). The other was recovered from a core taken from a depression of muddy sand off Halibut Bank (Flemming 2002).

A wide range of fossils have been identified in the Scottish North Sea (ScARF, 2012) and include:

- reindeer;
- bison;
- musk-ox;
- woolly mammoth;
- red deer; and
- woolly rhino

In recent years, the archaeological assessment of marine geophysical and geotechnical data acquired for constructed and planned projects in the North Sea has led to a much greater understanding of the potential for prehistoric, maritime and aviation archaeology. For example, assessment undertaken for Moray East Offshore Windfarm demonstrated the presence of palaeo-landscape features and sub-seabed deposits of palaeo-environmental interest. Similarly, assessment undertaken for the Hiwind and Beatrice Offshore windfarms identified a lack of such features, helping to define where such features are less likely to be present.

A borehole acquired in 2007 by Gardline Geosurvey (Gardline Surveys Limited, 2009) for the Blackbird oil and gas works indicated that the shallow geology (1.4 m) at the Blackbird site comprised grey silty SAND, soft grey pebbly CLAY and firm grey pebbly CLAY. Four boreholes were also acquired in 2006 for the Ettrick oil and gas works (RPS, 2013) which support the identification of the shallow geology in the site as Holocene/Witch Ground Formation, Swatchway Formation, Coal Pit Formation, Ling Bank Formation and Aberdeen Ground Formation. Similarly, sub-bottom profiler data undertaken in 2010 by Fugro for the Blackbird oil and gas works also identified Holocene Sediments, Witch Ground Formation, Swatchway Formation and Coal Pit Formation (Fugro, 2010). These sediments appear not to be of (geo)archaeological interest due to their glacial and marine origin, however, this would need to be confirmed by an archaeological review of the recently acquired geophysical data, and, if required, may include the archaeological assessment of any future, planned engineering led geophysical and geotechnical surveys.

There is little evidence for prehistoric sites in the nearshore area, with an initial search of the CANMORE database and map viewer not able to identify any such sites. The lack of sites is likely due to the harsh coastal environment in these areas. Most sites in the nearshore and intertidal areas relate to vessels and WW2 defences.

Within the Project Area (array area, offshore cable corridor, north of Peterhead cable corridor and South of Peterhead cable corridor) there are no Historic MPAs. These are designated areas, protected under Part 5 of the Marine (Scotland) Act 2010, which protect 'marine historic assets' of national importance which survive in Scottish territorial waters.

Marine historic assets are defined in law and include a wide variety of man-made structures, including wrecked vessels and aviation crash sites. It can also include more scattered remains such as groups of artefacts on the seabed or submerged prehistoric landscapes (Historic Environment Scotland, 2019)

There is potential for wreck and aviation remains to be present within the scoping area. There are eight UKHO records, which relate to 19^{th} and 20^{th} century vessels, six INSPIRE wrecks points which mirror the UKHO ones and 55 CANMORE records located in the scoping area. The two UKHO records that do not mirror the INSPIRE wrecks are 'dead' wrecks, meaning they have not been detected by repeated surveys and are, therefore, considered not to exist.

Additionally, during WW2 Peterhead was the second most bombed location in Britain, being bombed 28 times. This was because Peterhead was the first built up area the Luftwaffe reach during bombing runs from Norway (Taylor, 2010). Similarly, Aberdeen was bombed 24 times and Clydebank also saw several attacks. The development and cable corridor are likely to lay within the Luftwaffe flight path during these raids, so there is potential for aviation remains relating to these bombing runs located within the development sire and cable corridor.

During geophysical survey undertaken in 2021, one shipwreck the *Ernst Friesecke* a modern fishing vessel was identified in the northwest part of the site (Gardline, 2021). In addition, numerous boulders and debris items were identified across the site. The magnetic anomalies observed across the survey area were associated with either known infrastructure or debris items with the exception of the discrete anomalies which could not be referenced with any surface contacts on the SSS. These could represent unrecorded wreck remains or aviation remains.

This geophysical data and survey report will be reviewed by Royal HaskoningDHV's maritime archaeologists once available to inform the EIA. If required, the data would then be archaeologically assessed by a suitably qualified archaeological contractor.

The distribution of these records across the Project Area is presented in Figure 7.12

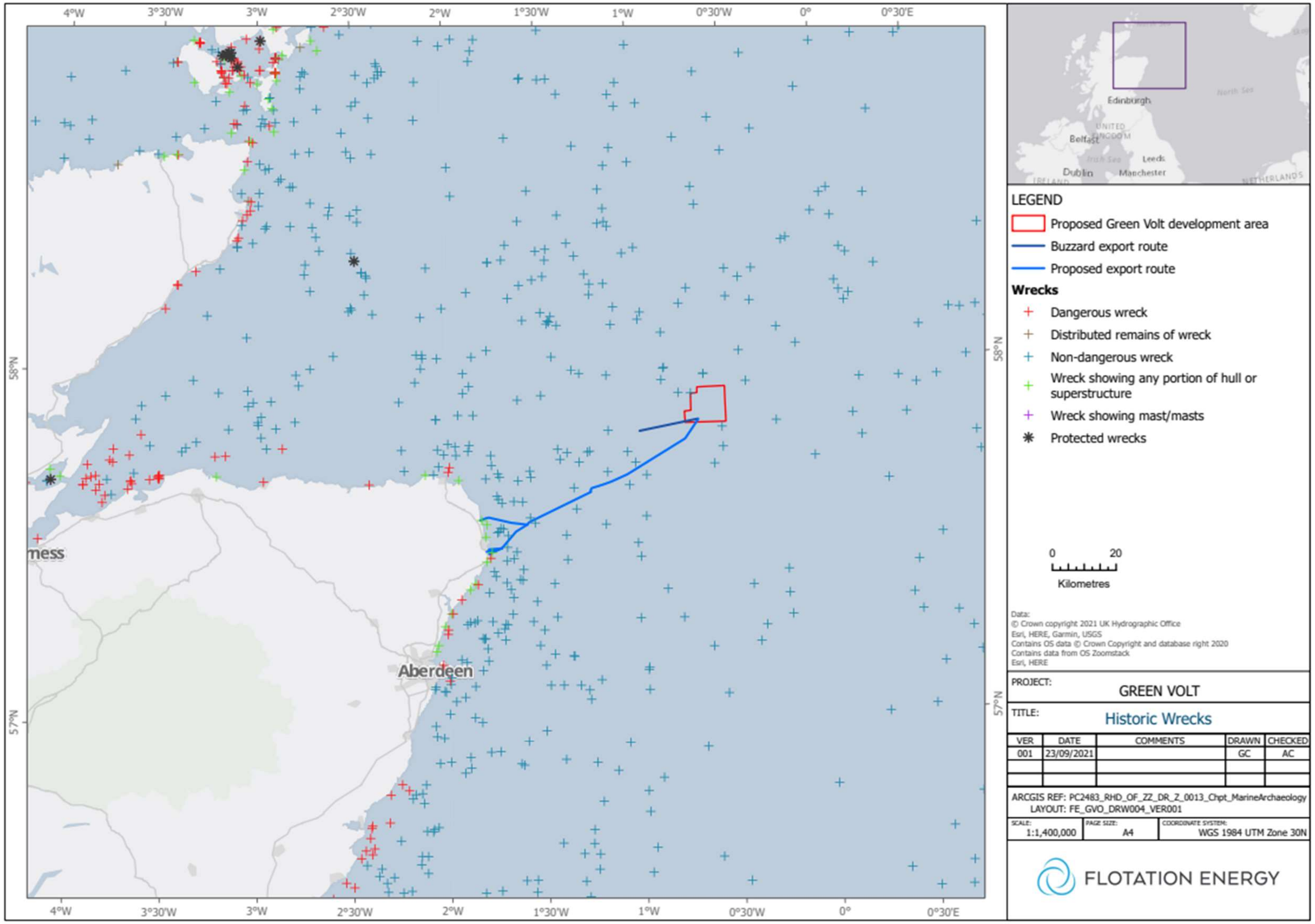


Figure 7.12 Historic Wrecks

Table 7.10 Distribution of heritage records across the scoping area

	Array area	Offshore cable corridor	North of Peterhead cable corridor	South of Peterhead cable corridor
UKHO	0	0	4	4
INSPIRE	0	0	2	4
CANMORE	0	1	26	28

The 55 CANMORE records largely relate to 19th and 20th century losses, with largest concentrations towards shore. These records do not necessarily relate to physical remains of vessels at the recorded locations, but document records of lost vessels which have the potential to be present, currently undiscovered, within the Project Area or in the wider region.

As part of the NorthConnect Interconnector assessment of geophysical data, two wrecks were identified outside the cable corridor. These were a motor vessel lost in 1925 and a fishing vessel lost in 1917. Both wrecks were surrounded by a debris field of varying size and complexity.

Within the NorthConnect Offshore Survey Corridor, four further wrecks were identified. Two of these were identified as debris, while another identified as a fishing vessel. The fourth was thought to have been the remains of an aircraft. Due to the character of the wreckage, it was recommended that unless further information becomes available, the site should be treated as if it were protected under the terms of the Protection of Military Remains Act 1986 (NorthConnect, 2018).

The potential receptors that may be present within the Project Area are summarised as:

- palaeo-landscape features and sub-seabed deposits of palaeo-environmental interest
- prehistoric occupation sites
- wreck and aviation remains
- occupation activity related to all periods of human activity within the intertidal zone.

7.4.2.1 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

7.4.3 Potential Impacts

Potential impacts to heritage assets include both direct and indirect impacts. Impacts can also occur form changes in the setting of heritage assets, which could affect heritage significance. This is set out in Historic Environment Scotland's guidance note *Managing Change in the Historic Environment: Setting*. This sets out the principles that apply to developments affecting the setting of historic assets or places including:

- scheduled monuments
- listed buildings,
- inventory historic gardens and designed landscapes,
- World Heritage Sites,
- conservation areas,
- historic battlefields,
- Historic Marine Protected Areas
- undesignated sites.

Direct impacts to heritage assets present on the seafloor or buried under the seabed, may result in damage to, or the destruction of any archaeological material. The relationship between that material and the wider environment (stratigraphic context or setting) may also be damaged or destroyed. These relationships are crucial to developing a full understanding of such material.

Direct impacts may occur if heritage assets or material are present within the footprint of the proposed scheme. (i.e., foundations or cables) or construction related activities such as seabed preparation, anchoring and the placement of jack-up feet.

The proposed scheme also has potential to directly and indirectly change the local and regional hydrodynamic and sedimentary process regimes. Changes tothe local and regional hydrodynamic and sedimentary process regimes can lead to the re-distribution of erosion and accretion patterns. Similarly, changes in tidal currents may affect the stability of nearby morphological and archaeological features.

Indirect impacts to heritage assets associated with these changes may occur if buried heritage assets become exposed to increased wave/tidal action, as these will deteriorate farther than assets protected by sediment. Conversely, if increased sedimentation results in an exposed site becoming buried, it may add some protection and considered a beneficial impact. However, it has been determined in Section 5 that the project will not result in changes to the local and regional hydrodynamic and sedimentary process regimes or to tidal currents. Therefore, there will be no indirect impacts to heritage assets. It is therefore proposed to scope out further assessment of indirect impacts to heritage assets associated with changes to physical processes.

Impacts to the significance of a heritage asset may also occur if a development changes the setting of the asset (the surrounding in which the heritage assets is located, experienced, and appreciated). It has been determined in Section 7.1that impacts to seascape, landscape, visual resources and cultural heritage onshore will not occur as the development is located 75 km offshore and outside the 50 km ZTV. However, the significance of heritage assets offshore, should these be identified, may still be impacted by a change in their setting resulting from the installed infrastructure. Similarly, historic character may also be affected if the proposed scheme results in a change to the prevailing character of the area and/or alters perceptions of the seascape. Setting and historic character are, therefore, scoped in for further assessment.

7.4.3.1 Potential Impacts During Construction

Direct impact may occur if archaeological material is present within the footprint of the proposed scheme associated with the following activities:

- seabed preparation (including UXO and boulder clearance and pre-lay grapnel runs along cable routes);
- installation of wind turbine moorings and mooring chains;
- installation of ancillary infrastructure;
- installation of offshore cabling;
- seabed contact by legs of jack-up vessels and / or anchors; and
- cable installation at the landfall.

If the NorthConnect cable corridor is used for Green Volt Offshore windfarm, the level of impact may be reduced as heritage assets located within it should have been identified and investigated. As such, if the NorthConnect Interconnector is constructed before Green Volt Offshore windfarm, any impacts to heritage assets will have been identified and mitigated.

There would also be potential for temporary impacts to the setting of onshore heritage assets, offshore heritage assets and to the Historic Seascape Character (HSC) from the presence of vessels associated with the installation of offshore infrastructure and activities at the landfall.

7.4.3.2 Potential Impact During Operation

Direct impacts may occur if archaeological material is present within the footprint of works required for routine maintenance activities which disturb the seabed (for example, seabed contact by legs of jack-up vessels and / or anchors). Similarly, this can occur in exceptional circumstances such as the replacement of cabling.

However, given the areas where such activities would be undertaken would already have been disturbed during construction, there would be limited further impact.

There would also be potential for impacts to the setting of onshore and offshore heritage assets and to the HSC from the presence of the installed infrastructure and ongoing maintenance activities.

7.4.3.3 Potential Impacts During Decommissioning

Direct impacts to heritage assets may occur if the accessible infrastructure is removed. This is not anticipated as any remains at the locations of the installed infrastructure will already have been impacted/mitigated during the construction phase.

If archaeological material is present within the footprint of jack-ups or vessel anchors deployed during decommissioning activities, direct impacts may also occur.

7.4.3.4 Potential Cumulative Impacts

Individual heritage assets would not be subject to cumulative direct impacts from other known plans or projects as they are discrete and there would be no physical overlap of different infrastructure. Similarly, should there be any interaction with NorthConnect, any potential impacts will have been identified and mitigated as part of the NorthConnect EIA process.

However, although individual assets are discrete, taken together they could have collective heritage significance. Therefore, multiple impacts upon similar assets could occur cumulatively. For example, there is potential for multiple developments to affect the larger-scale archaeological features such as palaeo-landscapes. The setting of heritage assets and the HSC of the North Sea may also be affected.

Section 5 has determined there will be no cumulative changes to marine physical processes as a result of the Project. As such, cumulative impacts to heritage assets as result of changes to marine physical processes is scoped out.

Therefore, the potential for cumulative impact associated with the construction, operation and decommissioning of other plans or projects is scoped out.

7.4.3.5 Summary of Potential Impacts

Table 7.11 outlines the effects which are proposed to be scoped into the EIA. This may be refined through the EPP as additional information and data become available.

Table 7.11 Summary of potential impacts to marine archaeology and cultural heritage (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Direct impacts to heritage assets.	✓	✓	✓
Indirect impacts to heritage assets associated with changes to marine physical processes.	x	x	x
Change to the setting of heritage assets, which	✓	✓	✓

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
could affect their heritage significance.			
Change to character which could affect perceptions of the HSC.	✓	✓	✓
Cumulative Impacts	x	x	x

In order to prevent significant impacts, it is recommended the following mitigation is embedded in the project design:

- The implementation of 50 m AEZ (Archaeological Exclusion Zones) around the extents of known wreck sites (A1s) and 50 m around the point locations of A1 magnetic only anomalies within which no development related activities will take place
- Avoidance where possible of identified anomalies (A2s) or previously recorded sites that have not been seen in the geophysical data (A3s) by micro-siting of design
- Further investigation of any identified anomalies (A2s) or previously recorded sites that have not been seen in the geophysical data (A3) that cannot be avoided by micro-siting of design.
- Further examination of potential prehistoric deposits including geoarchaeological recording of core samples, deposit modelling and archaeological input into any future sampling programme/s
- The archaeological assessment of any further geophysical data.

7.4.4 Approach to Impact Assessment

The marine archaeology assessment will be informed by the interpretation of the geophysical survey data (namely the MBES and SSS data to identify seabed features, such as wrecks, magnetometry data to identify magnetic anomalies and SBP data to identify buried features and sub-surface geological conditions).

In addition to the data listed in Table 7.12, the data in will be collected for the EIA assessment.

Table 7.12 Site-specific data

Data set	Source	Year Survey/Timings
Geophysical Survey (specifically Side Scan Sonar)	Green Volt cable corridor and array area.	To be confirmed
Grab samples at key locations	Green Volt offshore cable corridor and array area.	To be confirmed
Feature identification and video review [as required by feature analysis]	Green Volt offshore cable corridor and array area.	To be confirmed

All geophysical and geotechnical data acquired as part of the project will be reviewed and can be made available to an archaeological contractor for specialist archaeological assessment if required.

A marine archaeological desk-based assessment (ADBA) will be undertaken to establish and inform the baseline of the EIA for both known and potential heritage assets within the defined Project Areas based upon the desk-based sources listed in Table 7.12.

Dependent upon the results, a walkover survey at the landfall may be carried out to ground truth existing records of heritage assets and identify any potential unrecorded heritage assets. This may also be required to inform an assessment of potential setting impacts upon heritage assets below MHWS within the intertidal zone.

The ADBA and assessment of geophysical data will be used to identify a strategy for mitigation including the avoidance of identified heritage assets through the application of AEZ where appropriate.

The methodology of the assessment will also take account of guidance including:

- Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development (JNAPC and The Crown Estate 2006).
- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology 2007).
- Historic Environment Scotland guidance note Managing Change in the Historic Environment: Setting (Historic Environment Scotland, 2016)
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology 2008).
- Chartered Institute for Archaeologists' Standard and Guidance for Historic Environment Desk-Based Assessments (2014a) and Code of Conduct (2014b).
- Principles of Cultural Heritage Impact Assessment in the UK, IEMA, IHBC and CIfA 2021.

Consultation would be undertaken throughout the EIA process with all relevant heritage stakeholders, such as Historic Environment Scotland and the Aberdeenshire Archaeology Service. This will ensure that all the involved parties agree on the above approach and that further mitigation is proportionate and beneficial.

7.5 Offshore Social-Economics and Tourism

This section was produced by Dr Richard Wakefield of Flotation Energy.

The selection of the study areas for the socio-economic impact analysis will take account of the spatial scale at which impacts upon different receptors are likely to materialise. This is likely to vary across receptors and will require a localised study area and a larger regional study area. The study area will be linked to the selection of construction, and operation and maintenance ports and the supply of a range of inputs and services for the Green Volt Offshore Windfarm.

The local socio-economics study area will cover the Project Area and coastline authorities (Aberdeen and Aberdeenshire Councils). It will be linked to the selection of construction, and operation and maintenance ports and the supply of a range of inputs and services for the Green Volt Offshore windfarm.

A larger regional socio-economics study area will also be defined to reflect the wider reach of Scottish Gross Value Added (GVA), supply chain implications, impacts on the connected oil platforms and employment impacts that are likely to materialise through the development of project. This regional study area will be defined following review of the results of the socio-economics assessment being undertaken.

7.5.1 Data and Information Sources

The following baseline data have been collected from the following sources listed in Table 7.13.

Table 7.13 Baseline information – socio economics and tourism

Type/description of data	Source	Status
Importance of area for recreation and tourism	Tourism data for key locations and regional context e.g Visit Scotland or Historic Scotland	To be completed as part of the EIA process
Local supply chain and Scottish business infrastructure	Green Volt economic assessment	To be completed as part of the EIA process
Local employment rates	Scotland's Labour Market: People, Places and Regions Annual Population Survey 2019 (Scottish Government, 2019).	To be completed as part of the EIA process

7.5.1.1 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

7.5.2 Existing Environment

An overview of the population counts and demographic structure of the coastal settlements within the Aberdeenshire and Aberdeen council areas, as noted in Figure 7.13 with the associated population information for each council area presented in Table 7.14. In mid-2019, the median age across the local authorities within the Regional Study Area ranged from 36.5 years of age in the City of Edinburgh, to 47.1 years of age in Angus (National Records of Scotland, 2019). The percentage of the population in the working age group varied from 60% of the population of Angus, to 70% of the City of Edinburgh. These percentage contributions were also reflected within the pensionable age demographics, with the City of Edinburgh having the lowest total percentage within the pensionable age category (15%) compared to the highest in Perth & Kinross and Angus (23%) (National Records of Scotland, 2019).

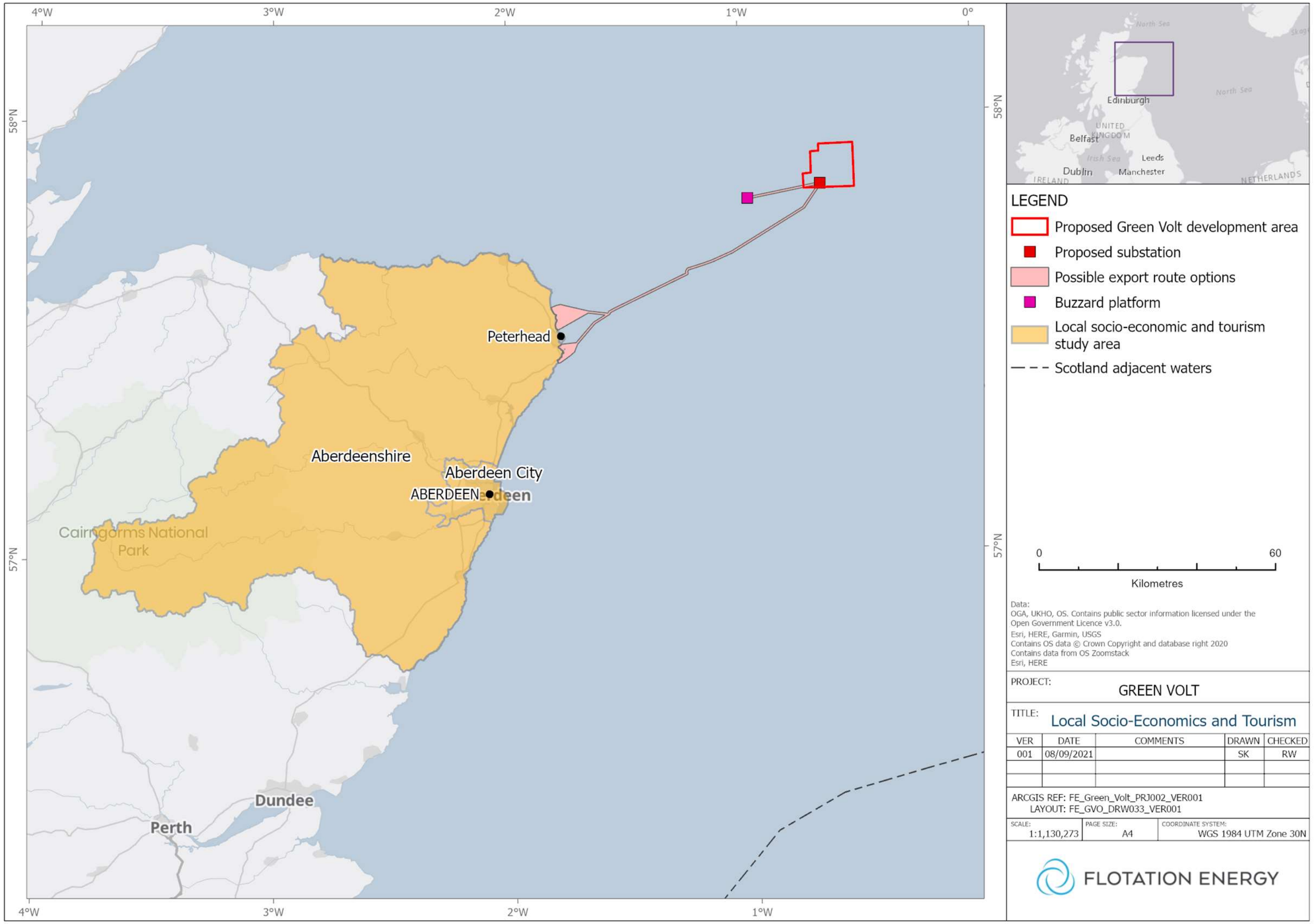


Figure 7.13 Aberdeenshire and Aberdeen City Council areas

Table 7.14 Estimated Mid-2019 populations of coastal settlements.

Local authority	Population count	Median age	Under 16 (%)	Working age (%)	Pensionable Age (%)
Aberdeen City	228,670	37.3	15	69	15
Aberdeenshire	261,210	44.0	19	62	19

The renewable energy sector has grown steadily in Scotland over the past few years, with an annual capacity increase of 800 MW between 2009 to 2019 (Scottish Renewables, 2020). Turnover from the renewable energy sector was £5,340 million in 2019, of which £889 million was related to the offshore wind sector (Scottish Renewables, 2020). A survey in 2019 suggest that around 22,260 full -time employees in the Scottish renewable energy sector which includes direct, indirect and induced jobs. The Fraser of Allander Institute report (Fraser of Allander Institute 2021) estimated that approximately 4,700 were within the offshore wind segment alone and that this number is expected to grow significantly over the next decade. This was therefore equal to the entire Scottish commercial fishing industry (4,860) (Scotland's marine economic statistics 2018), which only contributed £301 million to the Scottish economy.

GVA is a key indicator used to measure economic performance. Total GVA in the UK is £1,820 billion, and in Scotland is £138 billion. Annual GVA growth of 3.6% and 3.2% has been recorded in the UK and Scotland, respectively (Office for National Statistics, 2018). The GVA per head in the UK was estimated at £27,555 compared to £25,485 in Scotland (Office for National Statistics, 2018). GVA values for the combined areas of Aberdeen City and Aberdeenshire are significantly higher than the compared to Scotland and the UK as a whole, with a GVA in 2017 of 37,924 (ONS). This is predominantly due to the impact of oil and gas in these two council areas.

Therefore, extending the life of oil and gas fields through the electrification of existing assets is likely to maintain this higher-than-average GVA for the region and will likely be enhanced or maintained by increased offshore renewable jobs that are created as part of the INTOG and SCOTWIND processes.

7.5.3 Potential Impacts

A range of potential impacts on socio-economics and tourism have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Green Volt Offshore windfarm. Possible impacts relating to the potential changes to the socio economic and tourism of the area are considered in Table 7.15.

Table 7.15 Summary of potential impacts to marine archaeology and offshore social-economics and tourism (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Direct employment (all levels)	✓	✓	✓
Supply chain impacts	✓	✓	✓
Increase in demand for local private services/goods	✓	✓	✓
Interference with planned infrastructure	✓	✓	✓

improvements in the local area			
Nuisance Impacts e.g., noise, lighting	x	x	x
Impact on recreational activities e.g., coastal path walking	✓	✓	✓
Increased tourism/business interest to Scotland and local area	x	x	x

There is no specific guidance identified to assess the socio-economic impacts of the project, but as part of the project development a number of documents will be generated to estimate the expected cost of the project and the likely injection of funds into the Scottish economy as a result of this offshore INTOG site. It is likely to provide employment across a large number of sectors of Scottish industries during the construction phase and a positive impact during the O&M phase of work, with secondary benefits for other marine sectors such as the oil and gas sector.

Although the predicted effects of the project on socio-economics are considered to be localised to the Aberdeen City and Aberdeenshire region, there is potential for cumulative effects to occur from other projects or activities. Projects and activities which will be considered include:

- Offshore oil and gas installations and infrastructure
- other offshore windfarms and associated onshore cabling and infrastructure;
- offshore interconnector projects
- onshore energy generation projects;
- road projects;
- major residential, commercial and leisure projects; and
- minerals extraction and landfill projects.

7.5.4 Approach to Impact Assessment

Due to the deep offshore nature of the Green Volt Offshore windfarm, it is unlikely to support any recreational or tourism activities (a month-long radar survey undertaken to support the navigation chapter identified only one recreational vessel passing through the site on passage to Norway). The western boundary of the array area is approximately 75 km from the Aberdeenshire coastline and approximately 80 km from the closest recognised Royal Yachting Association (RYA) sailing area (Peterhead).

There are no known wrecks within the development area (see Figure 7.12) and along the proposed export cable route; however, the recent geophysical survey undertaken in 2021 has identified one shipwreck, a modern fishing vessel. However, the existence of this one modern wreck is not expected to attract recreational divers. Likewise, the seabed within the array area and proposed export cable corridor is relatively featureless and does not contain notable features which typically attract recreational divers. The nearshore and inshore waters which the proposed export cable corridor crosses may also support recreational sea angling.

As noted in Section 7.1, the Project Area is located out of visual range (>75 km) from the nearest shoreline location and therefore there will be no impact on visual amenity for tourism. There will be a very limited period during the export cable laying process when the cable lay vessel is close to shore, but this will be for a limited period during the construction phase.

7.5.4.1 Consultation

No additional consultation has been undertaken at this time as the data review has indicated limited impact from the development on the socio economics and tourism at the site and associated offshore export cable route.

There are no embedded mitigations considered for socio-economics receptors, as it is anticipated that the overriding socio-economic impacts of the Green Volt Offshore windfarm will be positive in nature. Consultation will be carried out with local stakeholders and public sector bodies, such as Scottish Enterprise, and through other activities that raise awareness of the opportunities that Green Volt provide to maximise the positive socio-economic impacts.

Several opportunities which could be considered to enhance the positive impacts include:

- the use of locally manufactured content where possible;
- the use of local contractors during construction for onshore infrastructure and potential offshore construction work where possible;
- the potential for cross-training across different offshore sectors, such as oil and gas to help the support the transition of skilled works into the offshore renewable industry
- employment and training possibilities for local people on the operation and maintenance of a windfarm where feasible; and
- supporting the community through sponsorship of local groups and teams.

7.5.4.2 Data and Information Gaps

No data gaps have been currently identified in the current socio economic and tourism section.

7.5.4.3 Proposed Additional Survey Requirements

No site-specific surveys have been undertaken to inform the Offshore Scoping Report for socio-economics and tourism and will not be undertaken to support the development of the Offshore EIA. This is because sufficient secondary data is available for the development of a baseline from which the potential impacts can be assessed and assess the potential impacts on the oil and gas platform operations.

7.6 Infrastructure and Other Marine Users

This section was produced by Dr Richard Wakefield of Flotation Energy.

7.6.1 Data and Information Sources

This section identifies the elements of the infrastructure and other users of relevance to the windfarm and offshore export cable corridor and considers the potential impacts from the construction, operation and maintenance, and decommissioning of the offshore and intertidal components (seaward of the MHWS mark) on these infrastructure and other user receptors.

7.6.2 Existing Environment

The infrastructure and other users study area is shown in Figure 7.14 this includes the array area and proposed export cable corridor.

The infrastructure and other users study area varies in scale depending on the receptor and has been divided into different areas according to each receptor, as listed below:

- infrastructure and other users study area: This area includes the extent of potential direct physical overlap between the Green Volt Offshore windfarm activities and the following receptors:
- recreational receptors (export cable only) (including receptors carrying out fishing, sailing and motor cruising; kite surfing; surfing; windsurfing; sea/surf kayaking and canoeing; and beach users);
- offshore energy projects (e.g. offshore windfarms, tide and wave projects);
- cable and pipeline operators;
- carbon capture and storage, natural gas storage and underground coal gasification;
- oil and gas.

The following baseline data have been collected from the following sources on the above receptors:

Table 7.16 Summary of infrastructure and other marine users

Type/description of data	Source	Status
Oil and gas infrastructure	OGA data	Obtained
UK coastal of recreational boating	RYA	Obtained
Offshore renewables	Crown Estate Scotland	Obtained
Offshore cables	KIS-ORCA	Obtained

7.6.2.1 Recreational Activity

The Green Volt site is located >75 km from shore and therefore is very limited recreational use associated with the development. An average 56 day period in the summer months (see Section 7.2) shows that recreational activity will be very limited and that vessels in this area will likely have AIS fitted to their vessels due to the distance from shore and size of such vessels.

Other recreation activities, including canoeing, kayaking, windsurfing, kite surfing and scuba diving can be found along the coast with activities expected to stay within 1 km of shore, with the exception of diving and therefore will only interact with the project during the installation period of the export cable.

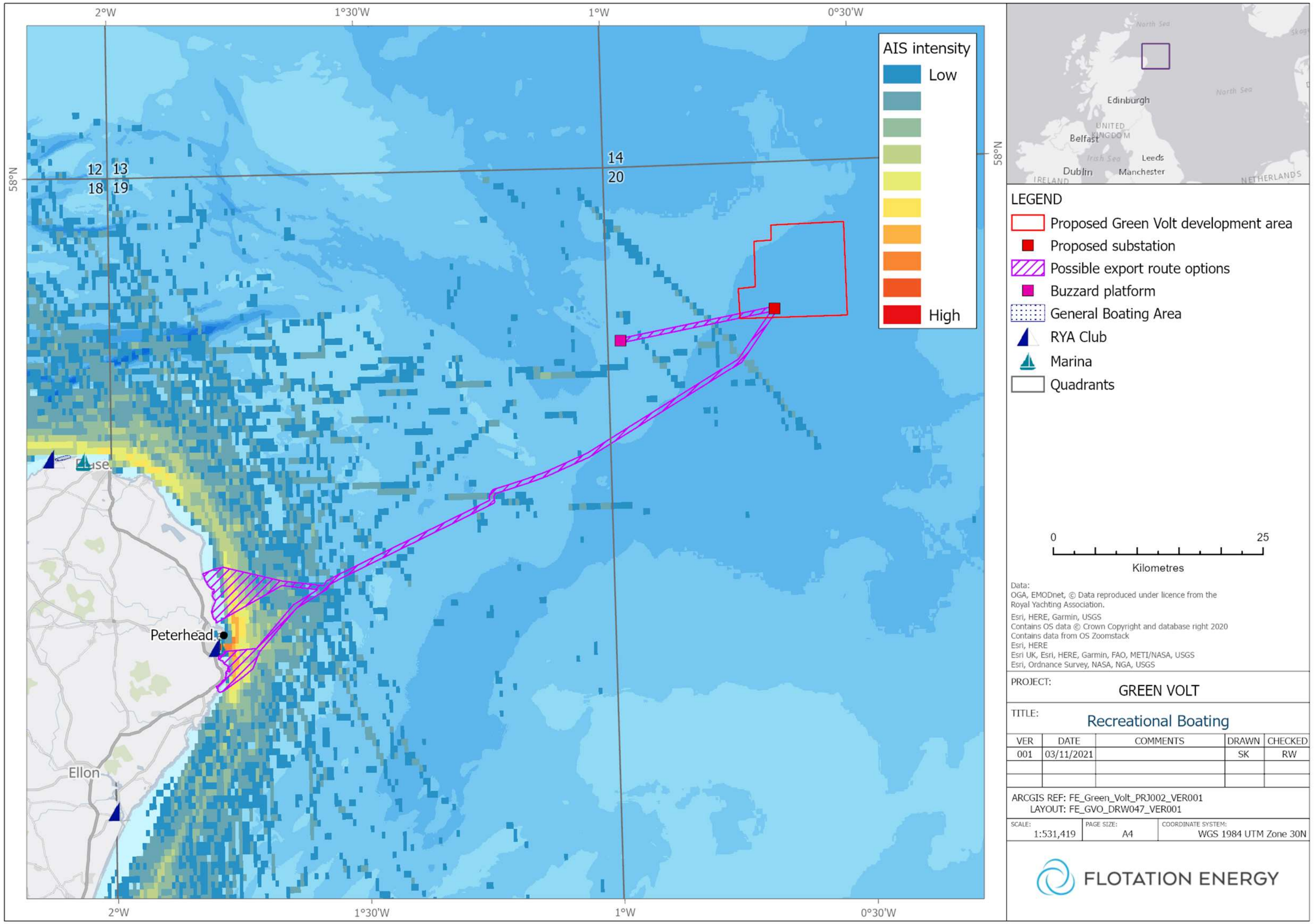


Figure 7.14 RYI map and Green Volt

7.6.2.2 Offshore Windfarms

The only offshore energy project currently within the Green Volt Offshore windfarm area is the Hywind Scotland windfarm that is located on the coast of Peterhead and approximately 52 km from the development area and the onshore export cable will cross the Hywind export cable as it approaches Peterhead (Figure 7.15). A crossing agreement will be obtained from the operator, as per standard offshore cabling procedures.

There are a number of Scotwind zones located to the north (NE7) and south (E2) of the development area, but currently no offshore windfarm leases have been awarded in these locations. It is expected that Crown Estate Scotland will issue a number of offshore leases in these areas, but this will not occur till the first quarter of 2022.

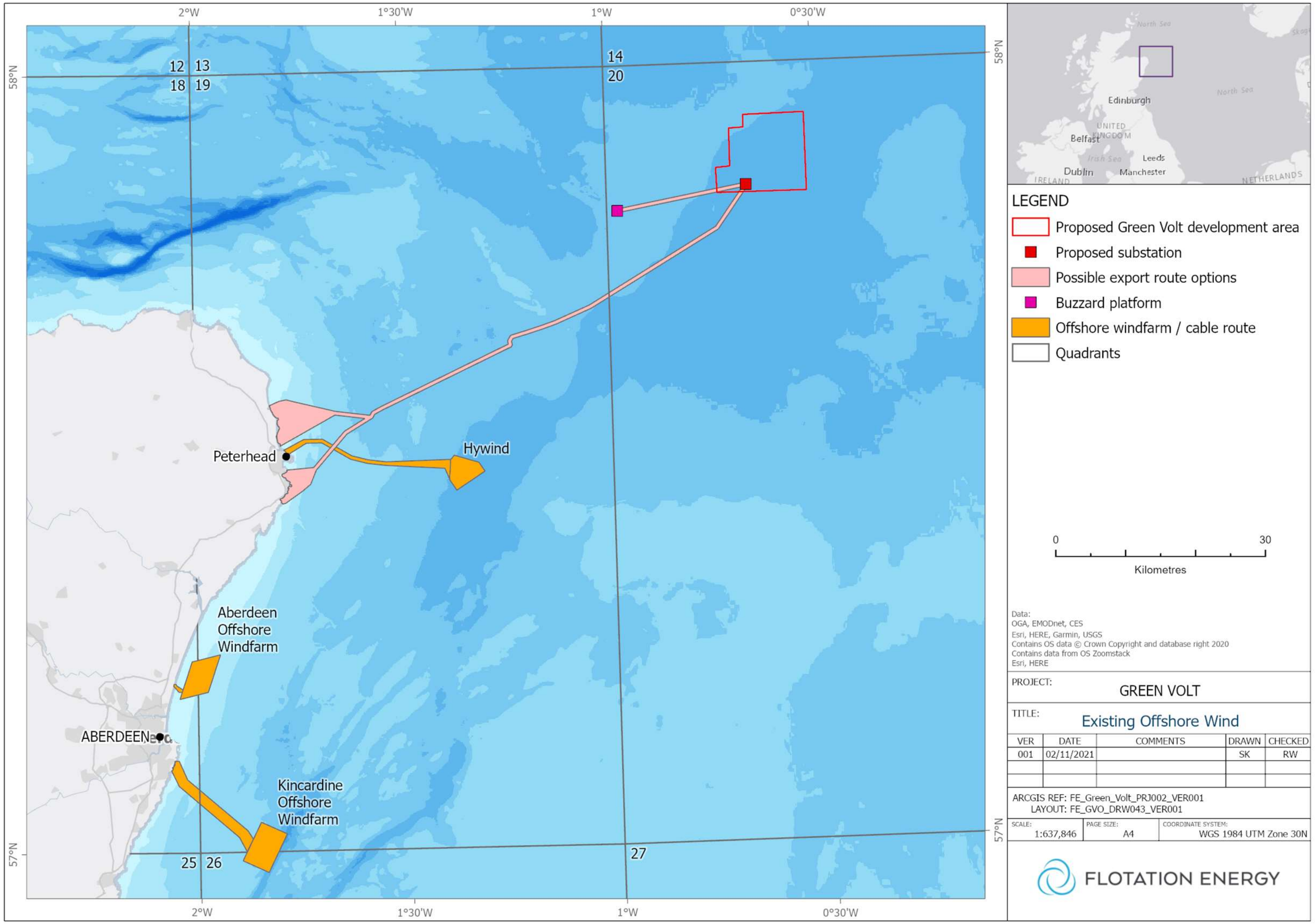


Figure 7.15 Offshore Windfarms in area of Green Volt

7.6.2.3 Oil and Gas Operations

The Green Volt Offshore windfarm site is located on the Ettrick and Blackbird oil field, which is currently finalising its final decommissioning scope. This will be completed ahead of the construction of the Green Volt Offshore windfarm. The main driver for this project is the decarbonisation of oil and gas operations in the North Sea through electrification from offshore renewable power, therefore it is intentionally located near to the Buzzard offshore oil platform and a number of other oil and gas installations with the primary aim to connect to them through relatively low voltage power cables (<66 kV). The Green Volt Offshore windfarm area was selected to be outside the normal operational activity range (supply vessels and helicopter routes) and has no impact on these receptors. It should be noted that the operator of the surrounding oil platforms is a partner in the development.

No pipelines are located within the windfarm area, but a number of oil pipelines will be crossed by the export cable to shore route and these will be managed by standard crossing agreements with the pipeline operators, with the aid of both OGA/BEIS and the project partners for Green Volt (Figure 7.16).

7.6.2.4 Carbon Capture

The ACORN carbon capture scheme is located to the north of the development site and the lease area is outside the development area (Figure 7.17). Although the development has gained a lease from Crown Estate Scotland, it was not successful in obtaining additional central government funding in the 2021 award process and therefore it is unlikely the project will proceed until the early or mid 2030s at the earliest.

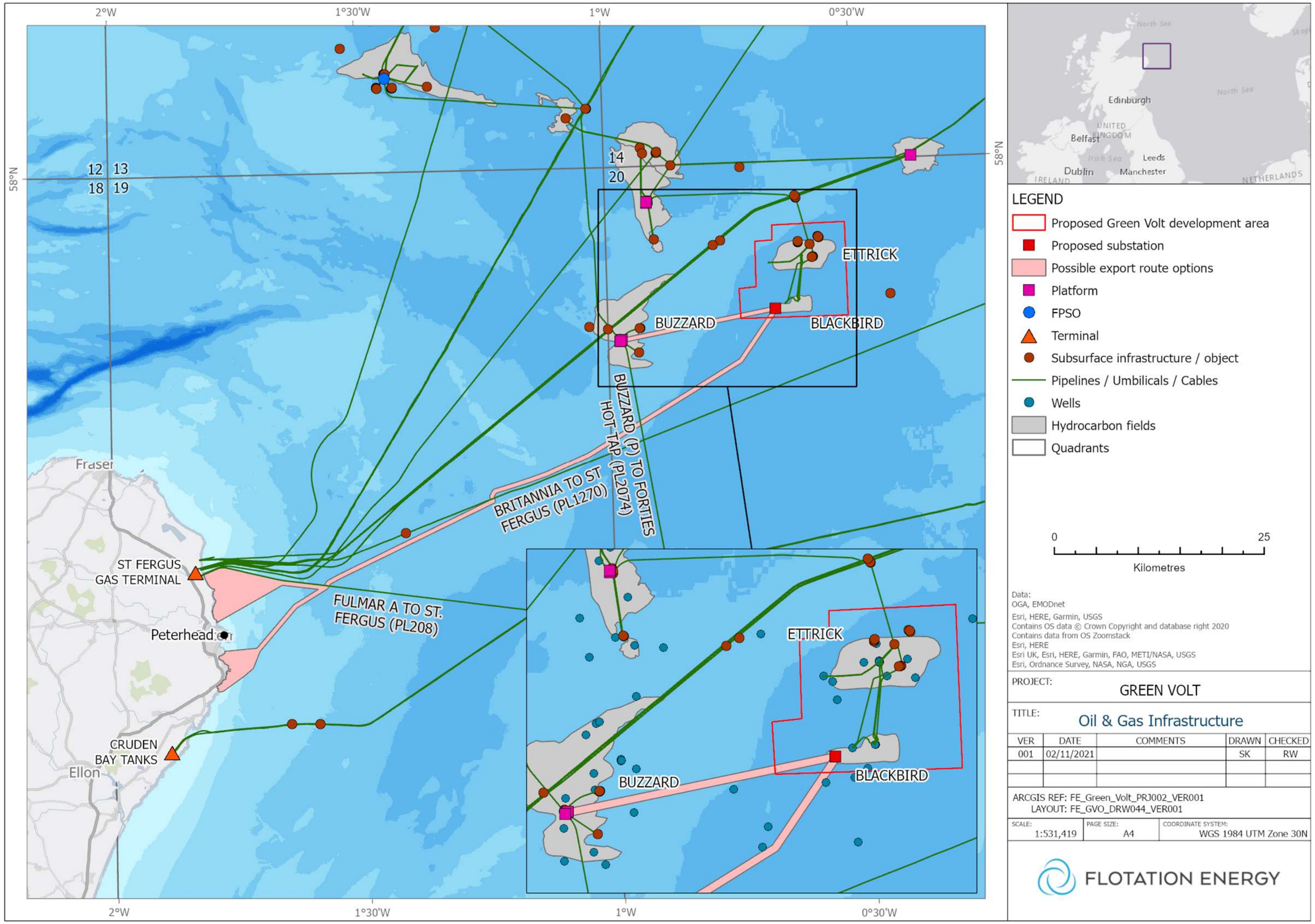


Figure 7.16 Offshore Oil and Gas

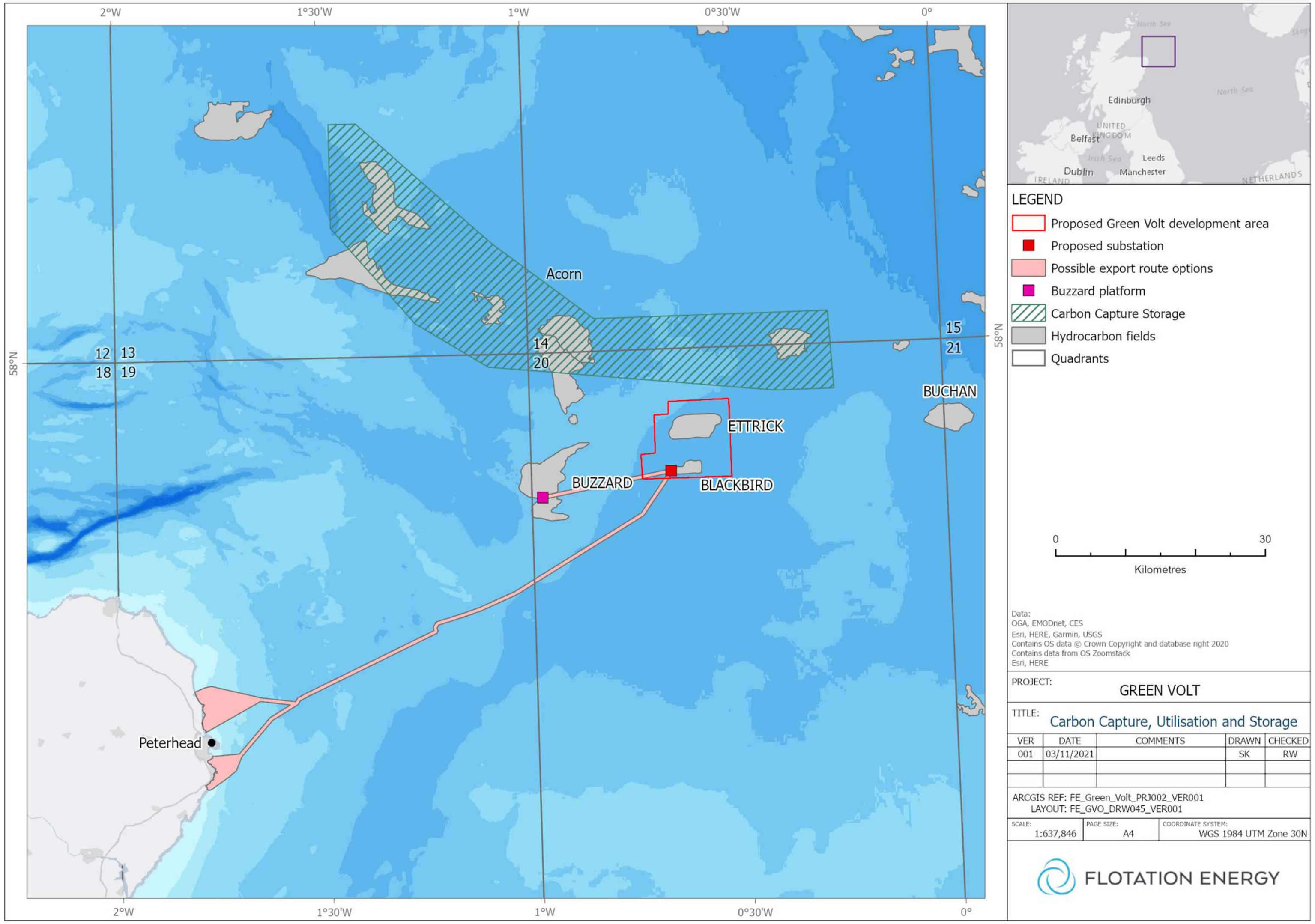


Figure 7.17 Offshore Carbon Capture Scheme and Green Volt

7.6.2.5 Subsea telecommunication cables

A review of the active and disused subsea cables has identified no telecommunication cables in the infrastructure and other users study area (inner) (Figure 7.16).

7.6.2.6 Marine disposal sites

A review of potential active or closed marine disposal sites identified no active or closed disposal sites within the infrastructure and other users study area (inner). The closest site is a disposal site, located approximately 1 km from the Peterhead landing area (operated by The Port of Peterhead), bordering the infrastructure and other users study area. Figure 7.18 presents the location of these disposal sites relative to the Green Volt Offshore windfarm site and export cable corridor.

7.6.2.7 Marine Aggregate Extraction Site

Although Scotland has a considerable marine sand and gravel resource, the marine aggregate industry has historically been very small due to more readily accessible land supplies. Marine aggregate licences have historically been issued to two sites in Scotland, one site in the Firth of Forth and the second site in the Firth of Tay (The Scottish Government, 2015) which do not overlap the infrastructure and other users study area. Marine extraction sites have therefore been removed from further consideration within this scoping report.

7.6.2.8 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

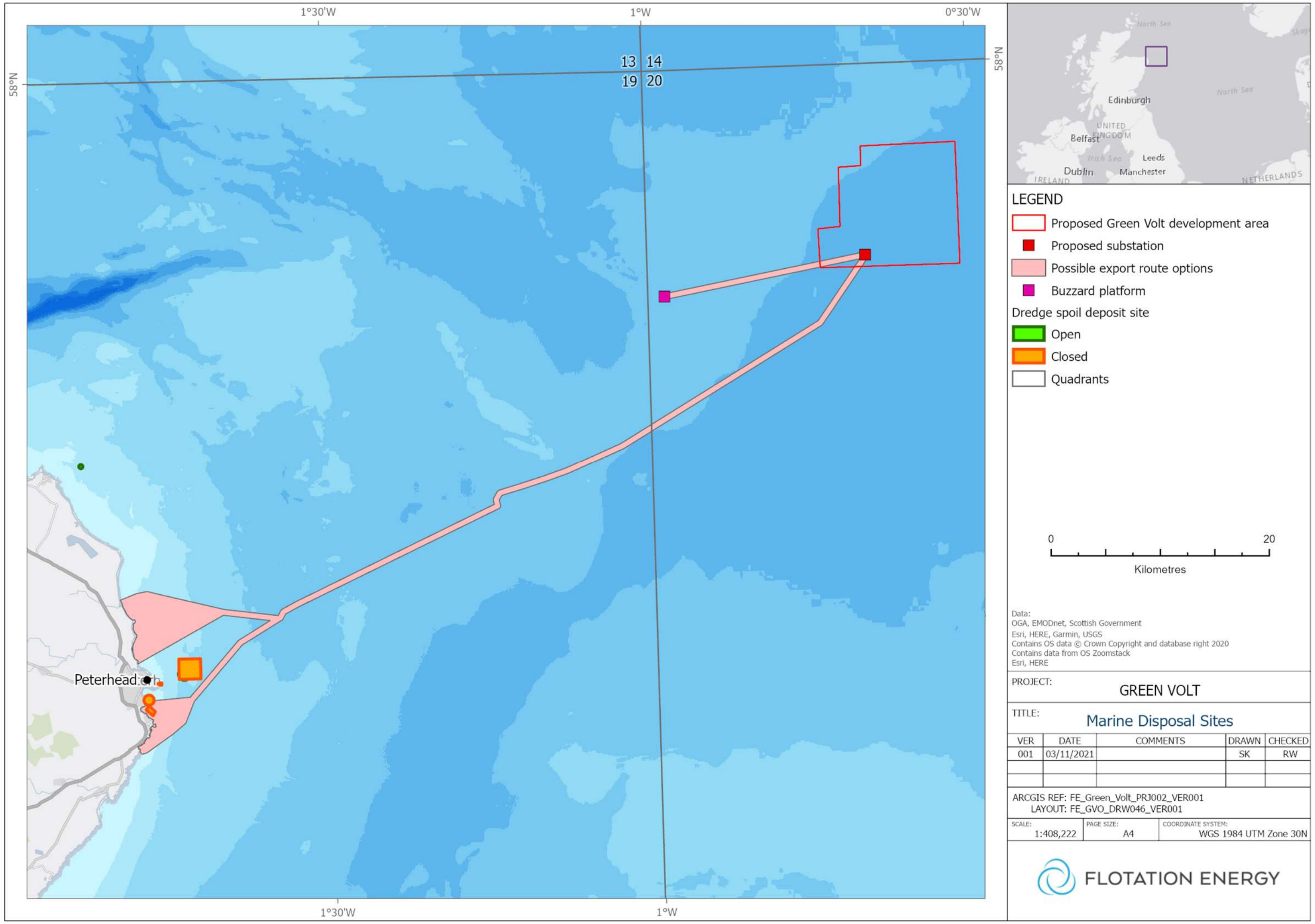


Figure 7.18 Disposal zones and Green Volt

7.6.3 Potential Impacts

The infrastructure and other users EIA will follow the methodology set out in Section 4. Specific to the infrastructure and other users EIA, the following guidance documents will also be considered:

- The RYA's Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy, June 2019 (RYA, 2019b);
- Assessment of Impact of Offshore Wind Energy Structures on the Marine Environment (Marine Institute, 2000);
- Guidance on Environmental Impact Assessment of Offshore Renewable Energy Development on Surfing Resources and Recreation (Surfers Against Sewage (SAS), 2009);
- European Subsea Cables UK Association (ESCA) Guideline No 6, The Proximity of Offshore Renewable Energy Installations and Submarine Cable Infrastructure in UK Waters (ESCA, March 2016);

ICPC recommendations:

- Recommendation No.2. Recommended Routing and Reporting Criteria for Cables in Proximity to Others (ICPC, 2015);
- Recommendation No.3. Criteria to be Applied to Proposed Crossings Submarine Cables and/or Pipelines (ICPC, 2014);
- Recommendation No.13. The Proximity of Offshore Renewable Wind Energy Installations and Submarine Cable Infrastructure in National Waters (ICPC, 2013);
- TCE and CES Agreements and Oil and Gas Licences (OGA, 2018);
- Oil and Gas UK, Pipeline Crossing Agreement and Proximity Agreement Pack (Oil and Gas UK, 2015); and
- TCE Guidance: Offshore windfarms and electricity export cables – crossing agreements (TCE, 2012).

Possible impacts relating to the potential changes to the infrastructure and other marine users of the area are considered in Table 7.17.

Table 7.17 Summary of potential impacts to infrastructure and other marine users (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Displacement of recreational sailing and motor cruising, recreational fishing (boat angling) and other recreational activities (diving vessels) due to safety zones and advisory safety distances in the array area and proposed export cable corridor may result in a loss of recreational resource.	✓	✓	✓
Installation of the export cable, including associated safety distances, may temporarily affect or restrict access to the	✓	✓	✓

Hywind Scotland offshore export cable.			
Installation of export cable, including safety distances, may temporarily affect or restrict access to the oil pipe.	✓	✓	✓

7.6.3.1 Potential Cumulative Effects

There is the potential for cumulative effects to occur as the result of the Green Volt Offshore windfarm with other plans or projects. The cumulative effects assessment will follow the methodology set-out in Section 4.

7.6.3.2 Potential Transboundary Impacts

No potential for transboundary impacts upon infrastructure and other users due to construction, operational and maintenance, and decommissioning impacts of the Green Volt Offshore windfarm.

7.7 Civil Aviation, Military, Unexploded Ordnance (UXO) and Communication

This section was produced by Dr Richard Wakefield of Flotation Energy.

This section presents the potential for effects of the project on the aviation, military, UXO and communications receptors of relevance to the Green Volt Offshore windfarm and considers the potential impacts from the construction, operation and maintenance, and decommissioning on aviation, military and communication receptors.

The potential effects of wind turbines on aviation are widely publicised, but the primary concern is one of safety.

Despite innumerable subtleties in the actual effects, there are two dominant scenarios that lead to potential impacts on aircraft:

- Physical obstruction. Wind turbines can present a physical obstruction to aircraft; and
- Impacts on aviation radar systems and the provision of radar-based Air Traffic Services (ATS). Wind turbines can create unwanted radar clutter which appears on radar displays and can affect the provision of ATS to pilots. Radar clutter (or false radar returns) can confuse air traffic controllers making it difficult to differentiate between aircraft and those radar returns resulting from the detection of wind turbines. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from ‘real’ aircraft away from the true aircraft position.

7.7.1 Data and Information Sources

The following baseline data have been collected from the sources listed in Table 7.18.

Table 7.18 Summary of civil aviation, military, UXO and communication

Type/description of data	Source	Status
Aviation and Radar	CAA and NATS self-assessment	Obtained
Military sites and activities	Independent radar consultant	Obtained
Potential for unexploded ordnance	UKHO and web based archies	To be undertaken as part of the EIA process and cable route survey
Military exercise and danger areas	Marine Scotland	Obtained

7.7.2 Existing Environment

7.7.2.1 Military Exercise and Danger Areas

Known military exercise and danger areas have been identified within Scottish waters and these are shown in Figure 7.19. As noted within the figure there are no known military exercise or danger areas noted within the area of the development area or the export cable routes.

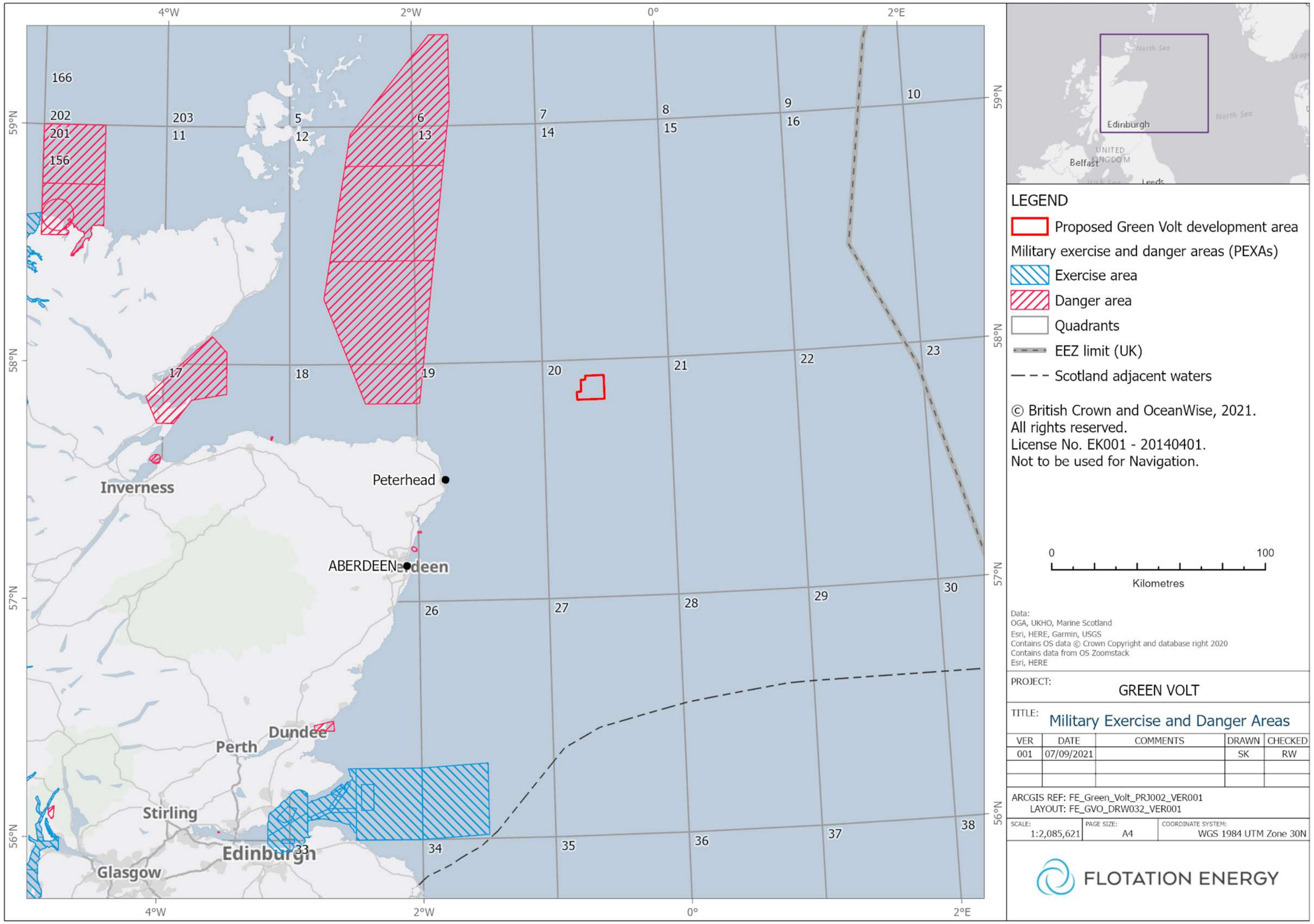


Figure 7.19 Military exercise and danger areas (PEXAs)

7.7.2.2 Aviation and Radar

The aviation, military and communications study area has been determined by the range of the affected aviation receptors; in particular, Air Traffic Control (ATC) and Air Defence (AD) radar systems. The operating range of these radars can be up to 200 nm (370 km); however, it is only the likely radar coverage over the Green Volt Offshore windfarm that has been taken into account and assisted in identifying the relevant radars, and stakeholders, that may be affected.

An initial review of the aviation, military and communications study area has been carried out in order to identify which aviation activities might be affected by the Green Volt Offshore windfarm; this included the following aviation receptors:

- Civil airport patterns and procedures
- Military aerodrome patterns and procedures;
- Civil ATC radar
- Military ATC radar
- Military AD radar
- Military low flying
- Helicopter Main Routes (HMR)
- Offshore helicopter operations (including Search and Rescue (SAR))
- Offshore helicopter installations (oil and gas platforms)

Figure 7.20 presents the civilian aviation activities relevant to Green Volt Offshore windfarm.

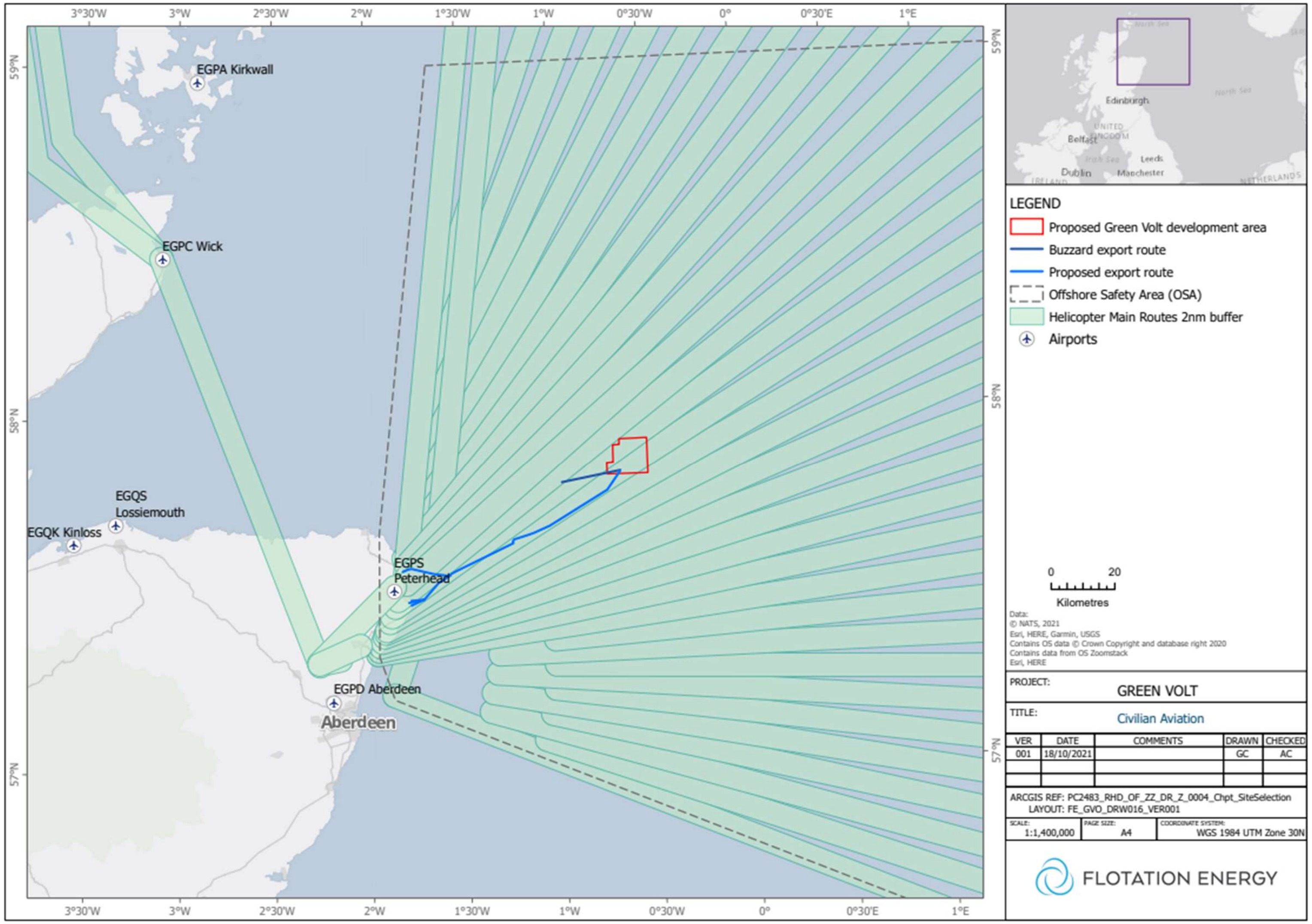


Figure 7.20 Civilian Aviation

The radars in the area of concern are addressed individually below and presented in Figure 7.21. There are three aspects to consider in establishing impacts, these are:

- the range to which the radars are used;
- the range to which the radars may suffer impacts from offshore turbines; and
- terrain screening preventing impacts.

The nearest civil airport is Aberdeen Airport, and the nearest military aerodrome is Royal Airforce (RAF) Lossiemouth.

In terms of aviation radar, it was identified that there are four relevant ATC and AD radar systems located throughout eastern Scotland and northern England. These radars provide coverage over much of the North Sea and could potentially be affected by the Green Volt Offshore windfarm. The relevant civilian and military radars are as follows (Figure 7.21):

- MoD Buchan AD radar
- MoD Leuchars Station ATC radar
- NERL Allanshill ATC radar
- NERL Perwinnes ATC radar

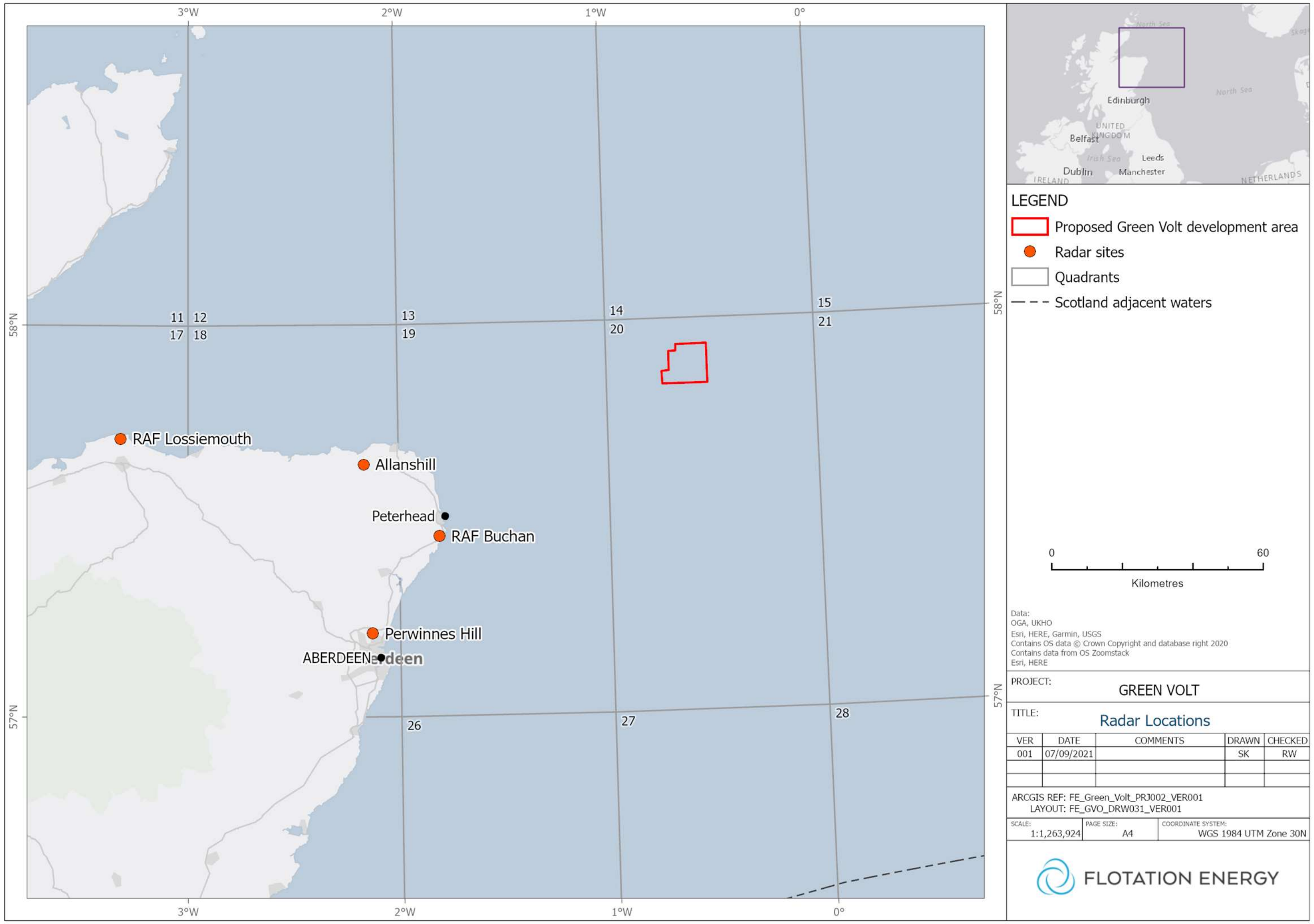


Figure 7.21 Summary of ATC and AD radar stations

7.7.2.3 RAF Buchan ADR

The MOD will use the Buchan radar out to the limit of its range at circa 470 km (Figure 7.22). However, the radar loses visibility of turbines before this range limit is reached due to the curvature of the earth. Simple radar Line of Sight (LoS) calculations against 250 m tip turbines, give a range limit of 110 km for the Buchan radar. In practice, it is known that the radars see beyond radar LoS on occasions due to anomalous propagation.

The MOD are known to have ‘concerns’ about Buchan impacts for NE8 and NE7 in the sectoral marine plan scoping consultation phase. Therefore, the conservative assumption would be that they would have concerns for the Green Volt Offshore windfarm project area under consideration.

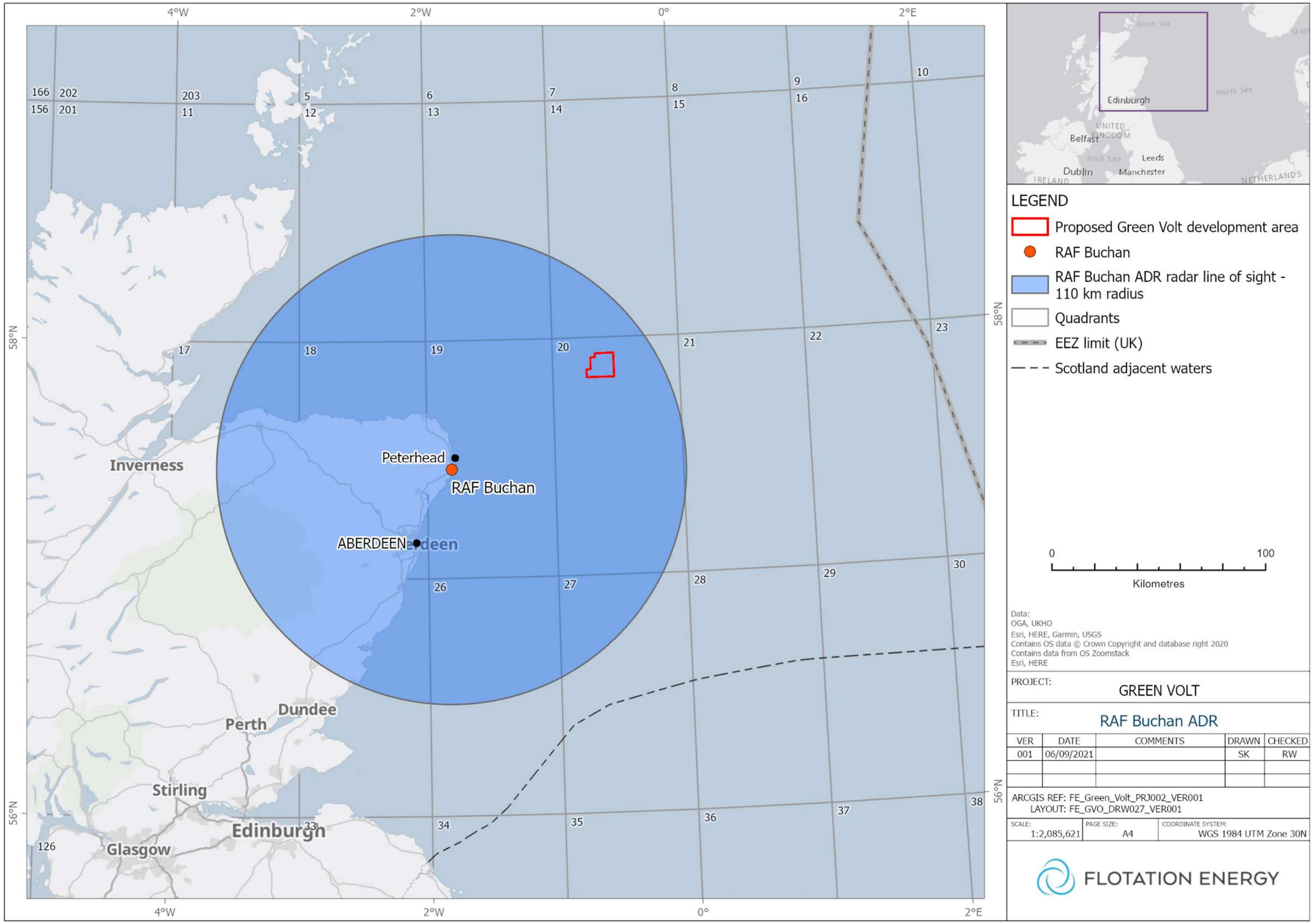


Figure 7.22 Buchan ADR radar LoS – 110 km

7.7.2.4 RAF Lossiemouth ATC

The Lossiemouth ATC is located within the Moray Firth and the Development is screened by a number of onshore topographic features. Given the degree of screening and the range to the Development area, the base assumption should be no objections on the basis of impacts to this radar. The radar line of sight is presented in Figure 7.23.

7.7.2.5 NATS Alanshill Primary Surveillance Radar (PSR)

NATS use this radar to a range of 60 nm or 111 km. The radar loses LoS visibility of turbines beyond this operational range at 116 km (Figure 7.24).

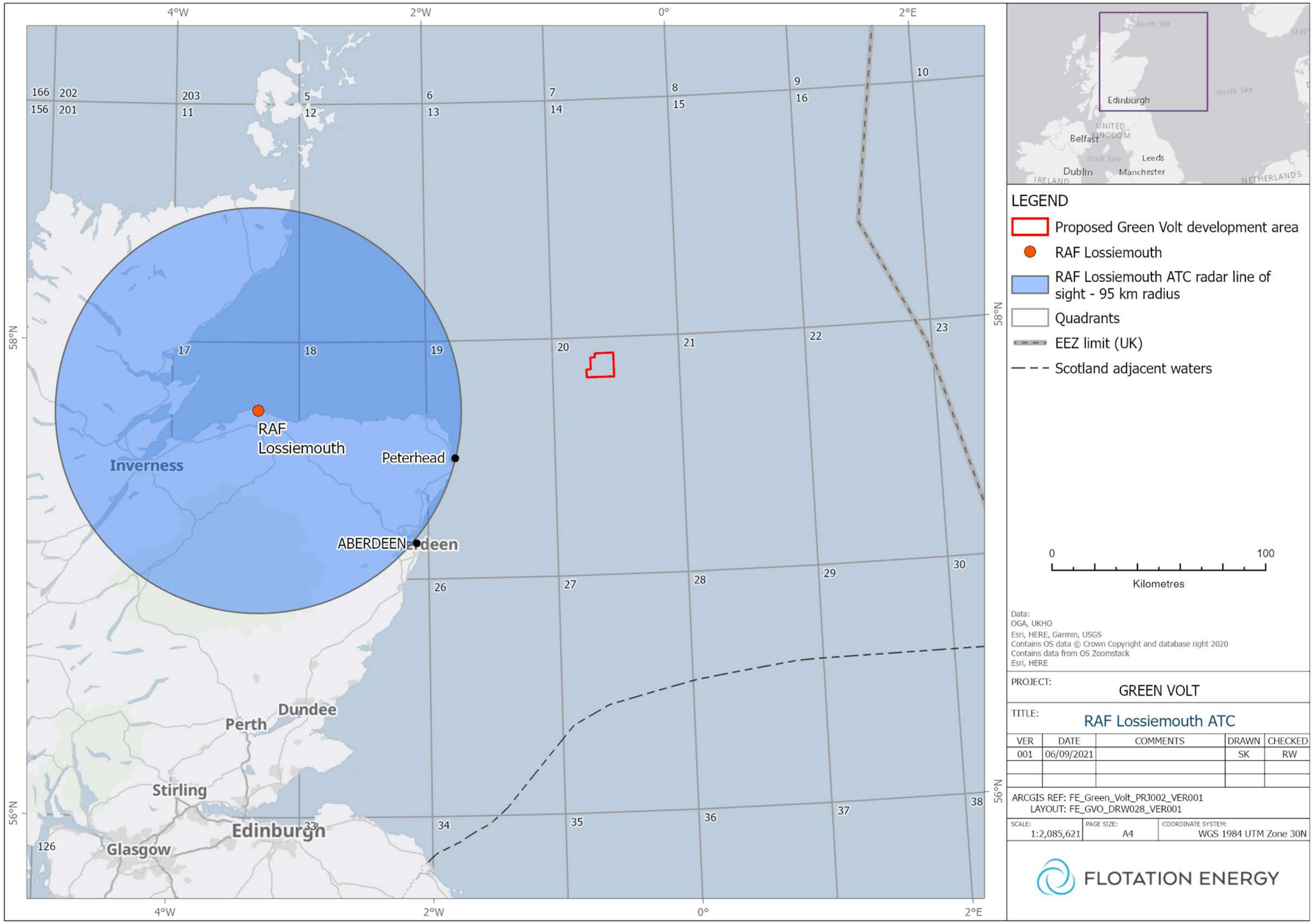


Figure 7.23 RAF Lossiemouth ATC radar LoS – 95 km

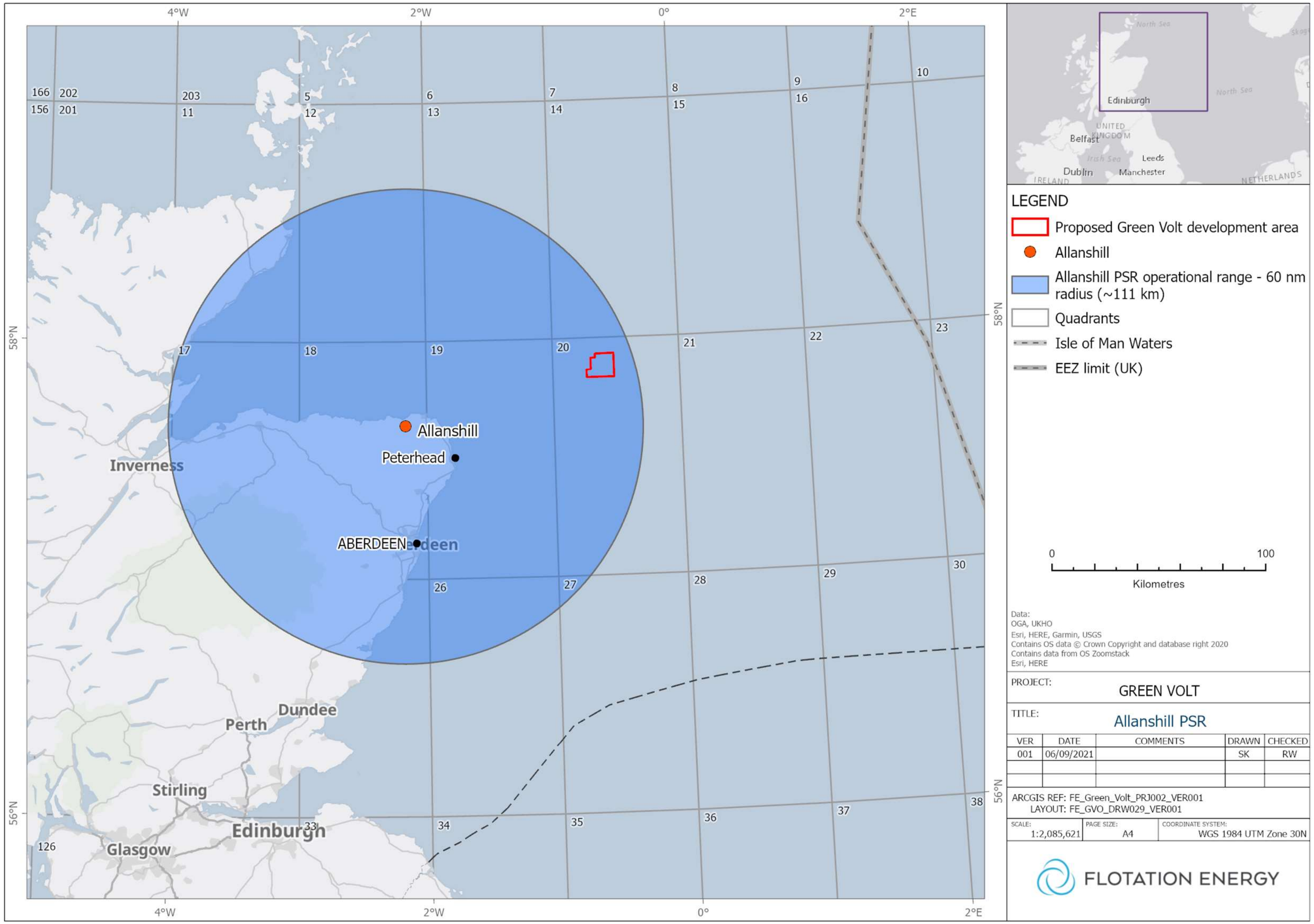


Figure 7.24 Allanshill operational range – 60nm

7.7.2.6 NATS Perwinnes PSR

NATS use this radar out to 160 nm (296 km) (Figure 7.25). However, the radar loses visibility of turbines before this range limit is reached, due to the curvature of the earth. Simple radar Line of Sight calculations against 270 m tip turbines, give a range limit of 109 km. In practice NATS have found that the radars see beyond radar LoS on occasions due to anomalous propagation. Perwinnes can detect turbines under some conditions out to the limit of its range, but with progressively decreasing frequency. There is as yet no hard and fast cut-off probability that gives a precise maximum range of impacts. None the less it is clear that this is well beyond the radar LoS range.

7.7.2.7 Unexploded Ordnance (UXO)

The potential for unexploded ordnance (UXO) within the Green Volt site and the export cable routes is limited due the significant amount of previous collected survey data over both the development site and export cable corridors. However, this location does have the potential for UXO within the site and along the cable route, as demonstrated by the location of the WW2 wrecks located alongside the export cable corridors and historical accounts from WW2 (see Section 7.4.2). A detailed UXO survey will be undertaken as part of the full geophysical survey of the site and the cable route to determine possible risk. This detailed assessment will take place during/following consent and it is expected that this will not be included within the EIA process at this stage; therefore, this be removed from the scope at this time. If UXO is identified and cannot be avoided, then appropriate separate marine licenses will be obtained to remove the identified UXO using the appropriate mitigation at the time.

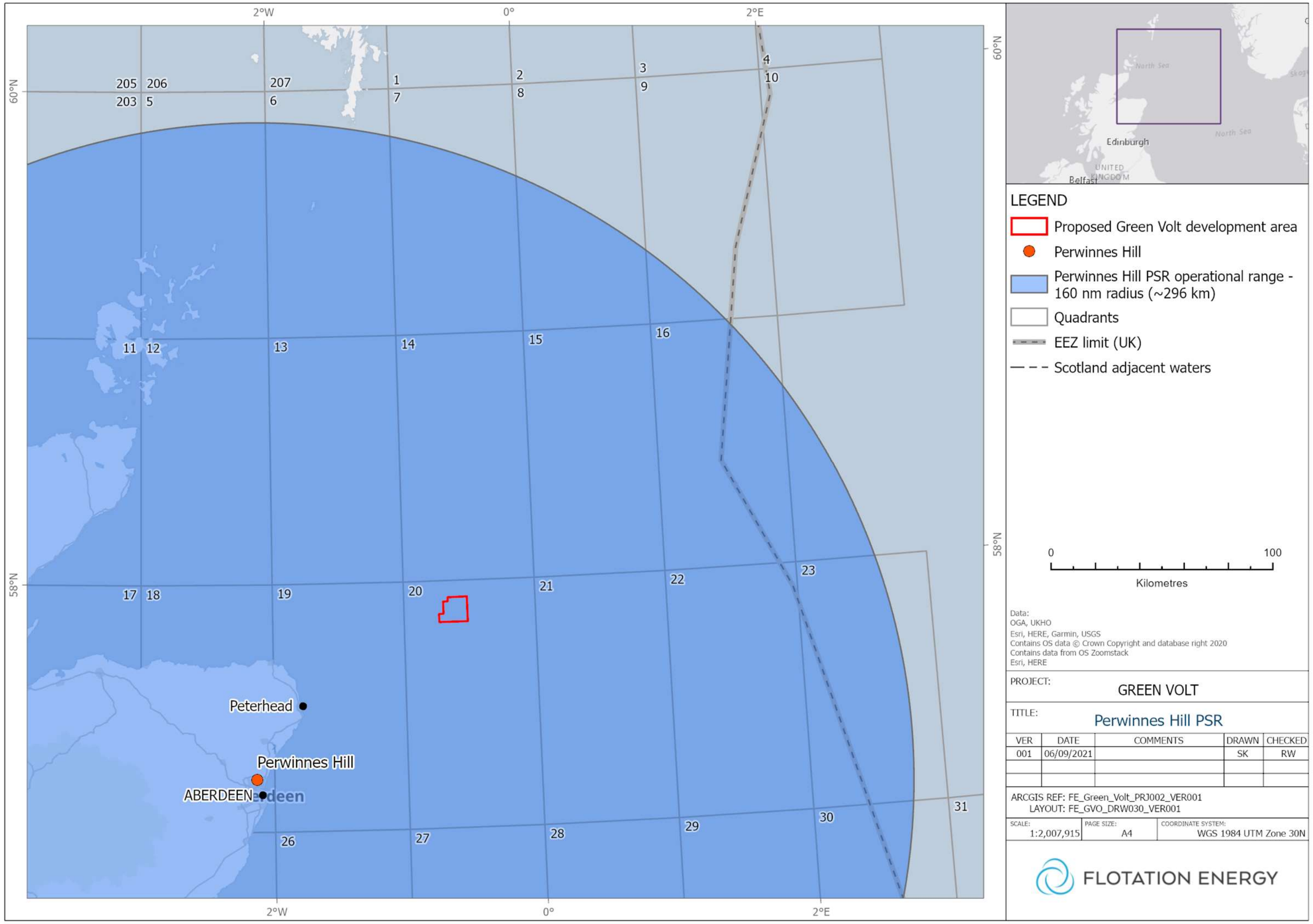


Figure 7.25 Perwinnes operational range – 160 nm

7.7.3 Potential Impacts

Possible impacts relating to the potential changes to the water and sediment quality of the area are considered in Table 7.19. There are no known military exercise or danger areas in the vicinity of the Project Area; therefore, this potential impact has been scoped out. Potential for UXO has been scoped out of the EIA assessment as a detailed survey for UXO will be carried out post-consent. Should any UXOs be removed, a full impact assessment will be carried out and the required marine licences and EPS licences will be sought.

Table 7.19 Summary of potential impacts to civil aviation, military, UXO, and communication (✓ = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Interference with long term military exercise or danger areas	x	x	x
Interference with aviation	✓	✓	✓
Interference with radar	✓	✓	✓
Potential impact on low flying (including SAR helicopter operations) due to presence of obstacles (cranes, stationary wind turbines).	✓	✓	✓
UXO	x	x	x

7.7.4 Approach to Impact Assessment

7.7.4.1 Consultation

Consultation / advice from CAA/NATS/Aberdeen International Airport/MoD will be sought; it is likely this will continue throughout the consultation and detailed design phase.

The aviation, military and communications offshore EIA will follow the methodology set out in above. Specific to the aviation, military and communications EIA, the following guidance documents will also be considered:

- Civil Aviation Publication (CAP) 393 – Air Navigation: The Order and the Regulations (2016);
- CAP 670 - Air Traffic Services (ATS) Safety Requirements (Issue 3, 7 June 2019);
- CAP 764 - CAA Policy and Guidelines on Wind turbines (Version 6, February 2016);
- CAP 774 - The UK Flight Information Services (Version 3, 25 May 2017);
- CAP 032 - UK Integrated Aeronautical Information Package (2020);
- Military Aviation Authority (MAA): MAA Regulatory Publication 3000 Series: Air Traffic Management Regulations (21 September 2018);
- MAA: Manual of Military Air Traffic Management (30 September 2019);
- UK Military Aeronautical Information Publication (2020);

- Marine Guidance Note (MGN) 543: Offshore Renewable Energy Installations - Guidance on UK Navigational Practice, Safety and Emergency Response Issues (19 August 2016); and
- CAA Visual Flight Rules Chart (CAA, 2020).

7.7.4.2 Data Gaps

No data gaps have been identified within the baseline information outlined in this section.

7.7.4.3 Embedded Mitigation for Green Volt Offshore windfarm

Measures adopted as part of the Green Volt Offshore windfarm will include:

- Adherence to CAP 393 Article 223 which sets out the mandatory requirements for lighting of offshore wind turbines. This will require approval and implementation of a Lighting and Marking Plan (LMP) which will set out specific requirements in terms of aviation lighting to be installed on the wind turbines. The LMP will be prepared in consultation with the CAA and other aviation stakeholders and will take into account requirements for aviation lighting as specified in Article 223 of the UK Air Navigation Order (ANO) 2016 and changes to International Civil Aviation Organization (ICAO) Annex 14 Volume 2, chapter 6, paragraph 6.2.4 promulgated in November 2016; and
- All structures > 91.4 m in height will be charted on aeronautical charts and reported to the Defence Geographic Centre (DGC) which maintains the UKs database of tall structures (Digital Vertical Obstruction File) at least ten weeks prior to construction.
- UXO treat risk assessments will be undertaken as part of the detailed cable route planning and these will be used alongside the existing site data to allow detailed route assessments and survey to be undertaken to determine the presence or lack of UXO within both the development area and export cable routes.

The requirement and feasibility of additional measures will be dependent on the significance of the effects on aviation, military, UXO and communications and will be consulted upon with statutory consultees throughout the EIA process.

7.8 Human Health

This section was produced by Royal HaskoningDHV.

This section sets out the methodology to be adopted in the assessment of impacts relating to human health and wellbeing ('health') and considers potential health effects on both the general population and vulnerable population groups, at both a local and regional level. The health assessment will bring together the conclusions of the assessments made in other relevant chapters of the EIA. The key inter-relationships occur in relation to marine sediment and water quality, air quality, noise, navigation and marine transport, landscape and visual amenity, and socio-economics and tourism.

This section considers the World Health Organisation (WHO) definition of health, which states that health is "*a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*". The focus of this topic is on community health and wellbeing and not on occupation health and safety.

7.8.1 Data and Information Sources

The relevant planning policies and legislation which underpin the assessment methodology for human health are set out in this section.

7.8.1.1 National Planning Policy

Considerations for health set out within the Third National Planning Framework (NPF3) (Scottish Government, 2014) are detailed in Table 7.20.

Table 7.20 NPPF Requirements for health

Paragraph/Section	NPF Requirement
Paragraph 1.2, First bullet	***"a successful, sustainable place.*** *We have a growing low carbon economy which provides opportunities that are more fairly distributed between, and within, all our communities. We live in high quality, vibrant and sustainable places with enough, good quality homes. Our living environments foster better* ***health*** *and we have reduced spatial inequalities in* ***well-being****. There is a fair distribution of opportunities in cities, towns and rural areas, reflecting the diversity and strengths of our unique people and places."*
Paragraph 2.16	*"Reducing the impact of the car on city and town centres will make a significant contribution to realising their potential as sustainable places to live and invest by addressing congestion, air pollution and noise and improving the public realm. Significant* ***health*** *benefits could be achieved by substantially increasing active travel within our most densely populated areas."*
Paragraph 4.4	*"Scotland's landscapes are spectacular, contributing to our quality of life, our national identity and the visitor economy. Landscape quality is found across Scotland and all landscapes support place-making. National Scenic Areas and National Parks attract many visitors and reinforce our international image. We also want to continue our strong protection for our wildest landscapes – wild land is a nationally important asset. Closer to settlements landscapes have an important role to play in sustaining local distinctiveness and cultural identity, and in supporting* ***health and well-being****."*
Paragraph 4.12	*"Scotland's environmental agenda is not only about playing to our strengths. In the coming years, we want to see a step change in environmental quality, especially in places with long-standing disadvantages arising from a legacy of past industrial activity. Vacant and derelict land is a continuing challenge. We are committed to reversing the decline of some habitats and species and regulating environmental pollution. Environmental quality is central to our* ***health and well-being****. Green infrastructure and improved access and education have a key role to play in building stronger communities. Our spatial strategy identifies where development needs to be balanced with a strategic approach to environmental enhancement."*
Paragraph 4.15	*"Creating walkable places, with well-designed streets that link our open spaces and wider active travel networks, can deliver better environments for pedestrians and cyclists in town and city centres, and improve* ***health and well-being****. We need to plan now for the kind of change to urban environments which is needed to support the vision in the Cycling Action Plan for Scotland (CAPS), and the National Walking Strategy, for example by rolling out 20mph zones to more residential and shopping streets and further application of the principles set out in Designing Streets. Our vision is for pedestrian and cyclist friendly settlements and neighbourhoods, to be connected by a coherent national walking and cycling network, making active travel a much more attractive and practical option for both everyday use and recreation. A planned approach will be essential if we are to achieve our vision for 10% of all journeys by cycle safely and effectively."*

Paragraph/Section	NPF Requirement
Paragraph 6.6, Bullet 6	*"The Central Scotland Green Network remains a national priority. This densely populated area is rich in cultural, industrial and natural assets. However, in some places past land use has left a legacy of disused land, poor quality greenspace and fragmented habitats. Here, a step change in environmental quality is required to address disadvantage and attract investment, whilst sustaining and enhancing biodiversity, landscape quality and wider ecosystems. Elsewhere, the challenge is to maintain the existing quality of place whilst delivering development in areas of particular pressure. This initiative is now well established, and in the coming years we believe that the priorities for the lead organisations should include promoting active travel, addressing vacant and derelict land and focusing action in disadvantaged areas, to maximise community and* ***health*** *benefits. We expect work to gather further momentum during the lifetime of NPF3. A variety of developments in Central Scotland will contribute to the network. Benefits will also emerge from links with the Metropolitan Glasgow Strategic Drainage Partnership, major area and canal-led regeneration projects and catchment-scale water management planning."*
Paragraph 6.6, Bullet 8	*"A National Long Distance Cycling and Walking Network is needed to enhance visitor and recreation experiences, as well as ensuring that Scotland's population has better access to the outdoors for* ***health and well-being****. Making better links between existing routes will improve connections between urban and rural, and inland and coastal areas. Whilst it has significant potential as a tourism resource, we also believe that this network can support active travel and contribute to* ***health and well-being****. The development should focus on making best use of existing path networks – Scotland's Great Trails, the National Cycling Network and the Scottish Canal Network. It should seek to close key gaps, upgrade connecting routes, build on local core path networks, and link with public transport. Other proposals to strengthen this network over this period do not need planning permission to be implemented but form part of a wider strategy to help achieve the vision for the national network over a 20 year period. A coherent plan for the network will be developed by key partners, led by Scottish Natural Heritage, immediately after adoption of NPF3. The national development description shows the priority 5 year projects within the context of the wider strategy."*

7.8.1.2 Legislation

The requirement to consider human health within the Environmental Impact Assessment (EIA) process was made explicit in The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Legislation relating to human health is generally driven by a wide range of acts and regulations linked to specific health related topics (e.g., transport (including navigation), noise, air quality, water quality (marine and freshwater), soils and waste, landscape, and environment), and these are presented in the relevant topic chapters.

7.8.1.3 Other Relevant Guidance

The Planning Practice Guidance on EIA (MHCLG, 2020) or 'promoting healthy and safe communities' (MHCLG, 2019b) do not provide additional information on defining the scope or assessment of 'population and human health' in EIA (as is required to be considered in The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017); therefore, the following guidance (inclusive of relevant UK guidance on HIA outside of Scotland) will be considered where appropriate in the assessment of the development on human health:

- Planning Circular 1/2017: Environmental Impact Assessment regulations (Scottish Government, 2017);
- Health Impact Assessment of Rural Development: A Guide. Scottish Health and Inequalities Impact Assessment Network and Scottish Public Health Network (ScotPHN) (Higgins *et al.*, 2015);
- NHS Scotland (2017), Place Standard Tool available at https://www.placestandard.scot/
- Health Impact Assessment in Planning: Thought pieces from UK practice. In Institute of Environmental Management and Assessment (IEMA) Impact Assessment Outlook Journal, Volume 8, October 2020;
- Institute of Environmental Management and Assessment (IEMA) – Health in Environment Assessment: A Primer for a Proportionate Approach (Cave *et al.*, 2017a);
- Health and Environmental Impact Assessment: A Briefing for Public Health Teams in England (Cave *et al.*, 2017b);
- Health Impact Assessment in spatial planning: A guide for local authority public health and planning teams (PHE, 2020a);
- Health Impact Assessment of Government Policy: A guide to carrying out a Health Impact Assessment of new policy as part of the Impact Assessment process (Department of Health, 2010);
- Healthy Urban Planning Checklist (London Health Urban Development Unit (HUDU), 2017b; 2019);
- Health Impact Assessment: A Practical Guide (Wales) (WHIASU, 2012); and
- Health Impact Assessment Guidance (Northern Ireland) (Metcalfe *et al.*, 2009).

7.8.2 Existing Environment

7.8.2.1 Introduction

The assessment will focus on the marine/offshore elements of the proposed project, and on the local population within a study area most likely to be affected. Existing baseline statistics will be obtained from publicly available data, such as from the National Records of Scotland (NRS)[7] and the Aberdeenshire Health and Social Care Partnership[8] (a partnership between Aberdeenshire Council and NHS Grampian), to provide information on population health (both general and vulnerable groups) in the study area. The human health impact assessment will bring together the conclusions of the assessments made in other relevant chapters of the EIA.

7.8.2.2 Health Statistics and Information

Table 7.21 to

Table *7.26* present relevant local statistics indicative of the population and health characteristics within the study area and wider surrounding area. It is noted that in 2020 there were three water transport related deaths (all adult males between 45 and 59 years of age) and 39 other drowning incidents across

[7] *Statistics | National Records of Scotland (nrscotland.gov.uk)*
[8] *Aberdeenshire Health and Social Care Partnership - Aberdeenshire Council - https://www.aberdeenshire.gov.uk/social-care-and-health/ahscp/*

Scotland, and six deaths due to falls from cliffs (all adult males between 30 and 64 years of age) across Scotland.

Table 7.21 Population age distribution (2020)

Area	Median age	Under 16	Working age	Pensionable age
Aberdeenshire	44.4	19%	62%	19%
Grampian	41.6	17%	65%	18%
Scotland	42.1	17%	65%	18%

Table 7.22: Abridged life expectancy (based on 2018 – 2020 data)

Age	Remaining Life Expectancy (years)					
	Scotland		Grampian NHS		Aberdeenshire	
	Males	Females	Males	Females	Males	Females
0	76.81	80.98	78.29	81.95	78.94	82.44
1	76.07	80.21	77.52	81.15	78.16	81.63
5	72.11	76.25	73.56	77.20	74.16	77.67
10	67.13	71.28	68.58	72.23	69.19	72.72
15	62.17	66.31	63.62	67.25	64.24	67.72
20	57.32	61.37	58.75	62.28	59.39	62.72
25	52.53	56.47	53.87	57.38	54.49	57.86
30	47.79	51.58	49.09	52.50	49.77	53.01
35	43.11	46.74	44.39	47.66	45.19	48.15
40	38.54	42.00	39.68	42.83	40.47	43.32
45	34.12	37.34	35.11	38.15	35.79	38.62
50	29.80	32.75	30.62	33.53	31.20	33.98
55	25.54	28.26	26.24	28.99	26.75	29.37
60	21.41	23.90	22.02	24.57	22.40	24.93
65	17.53	19.74	18.05	20.36	18.32	20.65
70	13.94	15.83	14.36	16.36	14.56	16.52
75	10.64	12.20	10.90	12.58	10.99	12.61

Age	Remaining Life Expectancy (years)					
	Scotland		Grampian NHS		Aberdeenshire	
	Males	Females	Males	Females	Males	Females
80	7.92	9.03	7.97	9.27	7.98	9.19
85	5.70	6.39	5.67	6.51	5.58	6.32
90	4.08	4.35	4.03	4.44	3.76	4.34

Table 7.23 Healthy life expectancy (based on 2017 – 2019 estimates)

Age	Remaining Life Expectancy (years)					
	Scotland		Grampian NHS		Aberdeenshire	
	Males	Females	Males	Females	Males	Females
<1	61.68	61.94	64.40	63.96	67.91	65.96
1 to 4	60.94	61.20	63.53	63.21	66.97	65.18
5 to 9	57.14	57.56	59.66	59.68	58.08	56.93
10 to 14	52.40	53.01	54.84	55.22	53.17	52.37
15 to 19	47.72	48.51	50.05	50.77	48.37	47.91
20 to 24	43.18	44.10	45.39	46.43	43.66	43.61
25 to 29	38.75	39.78	40.82	42.16	39.13	39.29
30 to 34	34.45	35.55	36.39	37.90	34.79	34.99
35 to 39	30.32	31.43	32.10	33.75	30.44	30.80
40 to 44	26.37	27.50	27.93	29.66	26.22	26.71
45 to 49	22.64	23.74	23.93	25.73	63.00	61.53
50 to 54	19.10	20.13	20.11	21.91	22.24	22.70
55 to 59	15.75	16.75	16.50	18.28	18.44	18.88
60 to 64	12.65	13.60	13.19	14.85	14.92	15.22
65 to 69	9.88	10.69	10.28	11.63	11.72	11.85
70 to 74	7.44	8.07	7.67	8.71	8.86	8.77
75 to 79	5.33	5.79	5.38	6.11	6.37	6.05
80 to 84	3.67	3.98	3.64	4.06	4.35	3.96
85 to 89	2.41	2.60	2.32	2.57	2.79	2.38
90+	1.54	1.67	1.55	1.72	1.72	1.70

Table 7.24 Standardised mortality ratios for selected causes (Scotland, 2020)

Cause		Scotland	Aberdeenshire
All deaths		100	86
Malignant neoplasms	**All sites**	100	94
	Stomach	100	79
	Large intestine	100	91
	Trachea, bronchus and lung	100	76
	Breast (female)	100	89
Ischaemic heart diseases		100	93
Cerebro-vascular diseases		100	94
Pneumonia		100	68
Dementia and Alzheimer's Disease		100	94

Table 7.25 Cause of death (Scotland, 2020)

Cause of Death	Population		Male		Female	
	Total	%	Total	%	Total	%
All causes	64,093	100.0	32,130	100.0	31,963	100.0
Malignant neoplasms	16,311	25.5	8,426	26.2	7,885	24.7
Ischaemic heart disease	6,727	10.5	4,202	13.1	2,525	7.9
Cerebrovascular disease	3,927	6.1	1,674	5.2	2,253	7.1
Dementia and Alzheimer's	6,352	9.9	2,179	6.8	4,173	13.1
Respiratory diseases	5,474	8.5	2,685	8.4	2,789	8.7
Accidents	2,759	4.3	1,713	5.3	1,046	3.3
Intentional self-harm	679	1.1	494	1.5	185	0.6
Other causes	21,864	34.1	10,757	33.5	11,107	34.7

Table 7.26 Deaths from road transport accidents (Scotland, 2020)

Year	Age Group					
	All	0-4	5-14	15-34	35-64	65+
2012	189	1	3	56	80	49
2013	185	1	5	64	67	48
2014	212	2	5	57	90	58
2015	181	-	5	51	79	46
2016	199	3	9	75	70	42
2017	168	1	1	42	74	50
2018	165	1	-	38	66	60
2019	184	-	1	38	87	58
2020	140	4	-	45	57	34

7.8.2.3 Buchan Area Information

Buchan (see Figure 7.26) covers the wider study area including the coast between Peterhead and Cruden Bay. The area has a population of 39,400 people, with Peterhead the largest town in the area with over 18,000 residents. The area is a mix of farms, villages and industrial areas (including the gas terminal at St Fergus and the Peterhead Power Station) along with Peterhead which is the principle white fish landing port in Europe, and a major oil industry service centre (Aberdeenshire Health and Social Care Partnership, 2017). Peterhead serves a broad range of industries including oil and gas, renewables, fishing and leisure. Figure 7.26 presents the key health assets within the wider area.

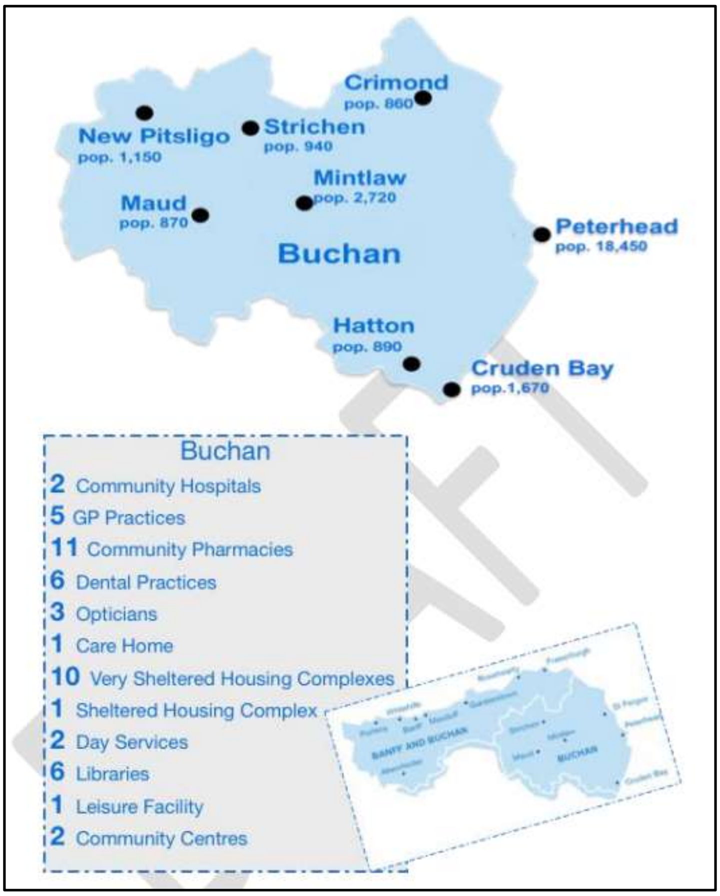


Figure 7.26 Buchan Area

The areas housing stock increased by 19.2% between 2005 and 2015 (Aberdeenshire Health and Social Care Partnership, 2017). Across the area life expectancy is generally above the Scottish average (except in parts of Peterhead which have significantly lower life expectancy). However, people over 65 years are more likely to experience emergency hospital admissions than the rest of the population, though the rate of emergency admissions for this age group is reducing yearly (Aberdeenshire Health and Social Care Partnership, 2017).

There are health concerns associated with alcohol and drug misuse for younger people, whilst the older generations the health priorities include combating fuel poverty and provision of sufficient carers to provide personal care (Aberdeenshire Health and Social Care Partnership, 2017). The area has the second highest rate within Aberdeenshire of mental health illness (Aberdeenshire Health and Social Care Partnership, 2017).

7.8.2.4 Health Priorities

The Scottish health priorities are:

- A Scotland where we live in vibrant, healthy and safe places and communities.
- A Scotland where we flourish in our early years.
- A Scotland where we have good mental wellbeing.
- A Scotland where we reduce the use of and harm from alcohol, tobacco and other drugs.
- A Scotland where we have a sustainable, inclusive economy with equality of outcomes for all.
- A Scotland where we eat well, have a healthy weight and are physically active.

The Buchan area health priorities identified by the Aberdeenshire Health and Social Care Partnership (2017) are:

- Reduce the number of unplanned hospital admissions particularly among older people and increase the number of people planning ahead to meet their needs in old age.
- Work with partners to improve the availability and quality of home care workers who provide care and support in rural areas.
- Improve understanding that professionals with additional training can take on other tasks to reduce demand on GPs.
- Develop signposting to services so they are more accessible, and the support they can provide is better understood.

7.8.2.5 Data Gaps

No data gaps have been currently identified, with the onsite survey fulfilling the remaining data requirements for the site. However, more detailed data may be obtained from National Records of Scotland, Aberdeenshire Council, and Grampian NHS if specific impact assessments are required that would need Lower Layer Super Output Area (LLSOA) granularity.

7.8.3 Potential Impacts

The anticipated impacts associated with the construction and operation of any of the proposed project has been guided by the wider determinants of health and wellbeing 'themes' included in PHEs 'Health Impact Assessment in spatial planning' guidance (PHE, 2020) and also referenced in the NHS' 'Healthy Urban Planning Checklist' (NHS, 2017). The key themes that are relevant to the project are the 'traffic and transport' (active travel), 'land use' (healthy environments) and potentially 'socio-economics' (vibrant neighbourhoods) (PHE, 2020; NHS, 2017).Table 7.27 presents the key impact sources that are potential determinants of health that could arise because of the project.

Table 7.27 Summary of potential impacts to human health (ü = scoped in, x = scoped out)

Potential Impacts	Construction	Operation & Maintenance	Decommissioning
Deterioration in air quality / dust / odour	x	x	x
Increased noise / vibration	x	x	x
Electro-magnetic fields (EMF)	x	x	x
Ingestion of hazardous substances	x	x	x
Deterioration in Bathing Water quality	x	x	x
Increased marine traffic / Navigation risk	x	x	x
Loss of land (agricultural / biodiversity capital)	x	x	x
Community severance	x	x	x

Reduced accessibility to infrastructure / public services	x	x	x
Increased employment	x	x	x
Loss of / increased local businesses	x	x	x
Influx of non-resident workforce	x	x	x
Loss of or increased pressure on existing health, education, recreation, or other community infrastructure or public services	x	x	x
Visual disturbance and / or alteration to landscape character	x	x	x
Cumulative effects	x	x	x

7.8.3.1 Construction

The potential impacts that may occur during construction of the proposed project were considered, and all the impacts would result in temporary disturbance factors that would be short-term and temporary and would not extend beyond a year (and most significantly less). As such, there would be no long-term health effects during construction and all impacts are scoped out of further consideration.

7.8.3.2 Operation

The potential impacts that may occur during the operation of the proposed project would be significantly reduced when compared to those of construction. Overall limited activity would take place inshore or nearshore and thus disturbance impacts would not be expected on any regular or frequent basis. Furthermore, the OWF structures themselves are over 80 km from the coast and as such would not be visible from the coastline within the study area and, therefore, any potential visual disturbance or perception impacts would not arise. As such, there would be no long-term health effects during operation and all impacts are scoped out of further consideration.

7.8.3.3 Decommissioning

At this stage, the nature of works required for decommissioning is unknown. However, it is anticipated that impacts during decommissioning would be similar in nature to those during construction. The scope of potential impacts during decommissioning will be defined at the scoping stage. However, given the temporary nature of decommissioning, the conclusion for the construction phase have been considered relevant and all potential decommissioning impacts are scoped out of further consideration.

7.8.4 Approach to Impact Assessment

This EIA methodology considers the key impacts which are likely to be associated with the proposed project (see Section 4 for further information on EIA methodology).

There are no specific guidelines which inform the management or assessment of health impacts. The impact assessment approach will use a framework for reporting on a range of data sources. Key sources of data include:

- scientific literature;
- baseline conditions;
- health priorities;
- consultation responses;
- regulatory standards; and
- policy context.

In line with good practice, the assessment process will include the identification and review of the potential public health impacts of the full life-cycle (i.e., construction, operation and decommissioning) of the project's features, including any emissions. The findings will be taken from individual relevant technical chapters from the EIA and collated in the health assessment.

7.8.4.1 Study Area

In line with industry guidance (PHE, 2020a), 'health determinants' are considered, to describe the potential effects of human health and wellbeing and inform the assessment on human health.

A wide variety of direct and indirect factors can influence human health. These vary from controllable factors (e.g., lifestyle) to uncontrollable factors (e.g., genetics). The influences and effects can be wide-ranging and are likely to vary between individuals. External contributary factors (known as 'determinants') are considered in determining 'physical, mental and social wellbeing' and are a reflection of a mix of influences from an individual's society and environment.

The 'wider determinants of health' model (Barton and Grant, 2006) is used to conceptualise how human health spans environmental, social and economic aspects. Influences that result in a change in determinants have the potential to cause beneficial or adverse effects on health, either directly or indirectly. The degree to which these determinants influence health varies, given the degree of personal choice, location, mobility and exposure.

The key steps in the assessment are:

1. Consider the likelihood of the project having an effect, and such an effect should be both plausible and probable. This should identify health pathways using the source-pathway-receptor model to transparently identify the likely effects.
2. Determine the significance of the effects, by characterising sensitivity of the receptors affected (described in detail in Section 7.8.4.2) and then determining whether a change in a population's (or population group's) health would arise that is significant (described in detail in Section 7.8.4.3).

The health assessment study area will focus on a site specific and local study area (i.e. using Middle Super Output Area (MSOA) and the wider regional study area (Aberdeenshire Council) as influenced by the various influences and determinants on health that are relevant for this project. The key determinants are marine transport and navigation, landscape and visual amenity, noise and vibration, air quality and odour, and marine sediment and water quality. As this scope considers offshore construction and operation the specific onshore components are not included or considered. Based on the above, and of relevance to the receptors, the study area therefore is focussed on the MSOAs closest to the coastline and landfall areas, which are:

- Longside and Rattray – S02000092;
- Peterhead Ugieside – S02000089;
- Peterhead Harbour - S02000088;

- Peterhead Bay - S02000086;
- Peterhead Links - S02000085; and
- Cruden - S02000082.

At this scoping stage the initial consideration will be based on the potential effects from the above determinants and how that may translate into health effects on the nearest receptor populations. Where a potential health impact is anticipated on the closest health receptor, then the subsequent EIA stage would identify the full study area and receptors at risk.

7.8.4.2 Sensitive Receptors

7.8.4.2.1 Types of Receptors

Health impacts will be assessed across geographic population groups (i.e. site-specific, local, regional and national) and at potentially vulnerable groups (i.e. children and young people, older people, people with existing poor health and people living in deprivation, including those on low incomes).

7.8.4.2.2 Sensitivity of Receptors

The factors that characterise sensitivity for human health are outlined in
Table 7.28. A formulaic matrix approach to determining sensitivity has been avoided in line with best practise. The sensitivity score can be high, medium, low or negligible. The ‘higher’ and ‘lower’ characterisations used in
Table 7.28 represent instructive positions on a spectrum. It is likely that situations will have a mix of higher and lower factors. As such, an expert view of sensitivity should be taken.

Table 7.28 Factors characterising population sensitivity (Cave et al., 2017a)

Factor	Lower sensitivity	Higher sensitivity
Inequalities	Low levels of inequities or Inequalities.	High levels of inequities or Inequalities.
Deprivation	Overall deprivation levels low or low for a relevant sub-domain of the indices of multiple deprivation. Good access to financial, social or political resources.	Overall deprivation levels high or high for a relevant sub-domain of the indices of multiple deprivation. Poor access to financial, social or political resources.
Health status	Low levels of poor health and/or low levels of disability. Low reliance, or high capacity, for healthcare facilities, staff or resources.	High levels of poor health and/or disability (particularly multiple or complex long-term health conditions). High reliance, or low capacity, for healthcare facilities, staff or resources.
Life stage	Predominantly a working age population in steady, good quality employment.	Presence of various dependents (particularly children or elderly), pregnant women, shift workers or the economically inactive.
Outlook	No indication that strong views are held about the project. People are well informed of the issues and potential effects.	Existence of groups with strong views and/or a large amount of uncertainty about the project. These groups may anticipate risks to their health and thus be affected by not only actual changes, but also by the possibility of change.

7.8.4.3 Definition of Impact Magnitude and Significance

The factors that characterise magnitude for human health are outlined in Table 7.29. A formulaic matrix approach to determining sensitivity has been avoided in line with best practise. Instead this assessment relies upon specific factors that relate directly to population groups as demonstrated. The magnitude score can be large, moderate, small or negligible. The 'larger' and 'smaller' characterisations used represent instructive positions on a spectrum.

Table 7.29 Factors characterising population magnitude (Cave et al., 2017a)

Factor	Smaller magnitude	Larger magnitude
Severity	Small change in symptoms, quality of life or day-to-day functioning. Small change in the risk of developing a new health condition (or injury) or in the progression of an existing condition. Small change in inequalities.	Large change in symptoms, quality of life or day-to-day functioning. Large change in the risk of developing a new health condition (or injury). Large change in the progression of an existing condition. Large change in inequalities.
Extent	Few members of the relevant population. Little change in population.	Most members of the relevant population affected or vulnerable. Substantial population displacement or influx.
Frequency	Monthly or yearly affects with acute (short term) changes in health outcomes.	Continuous or daily effects with chronic (long term) changes in health outcomes.
Reversibility	Change in health outcomes reverses once the project change ceases. No intergenerational effects.	Permanent change in health outcomes. Intergenerational effects.
Exposure	A low concentration over a short time. Low exposure to a small population. A low degree of resource sharing with the project.	A low concentration over a long time, or a high concentration over a short time. Low exposure to a large population or high exposure to a small population. A high degree of resource sharing with the project.

Once a source, pathway and receptor for a plausible health effect have been identified, and the sensitivity and magnitude considered, a professional judgement is made as to whether the change in a population's health is significant. The characterisation of sensitivity and magnitude is consistent with other EIA topics. However, other relevant information sources also feed into the professional judgement on significance. This ensures the conclusions on population health outcomes are reasoned and robust.

7.8.4.4 Approach to Mitigation

As the health assessment will be based on the findings from other technical assessments, mitigation measures will be proposed in those assessments where relevant to reduce impacts on human health and wellbeing.

7.8.4.5 Supporting Technical Assessments

No supporting technical assessments are required for health, though this assessment will be informed by the assessments for topics such as marine sediment and water quality, air quality, noise, navigation and marine transport, landscape and visual amenity, and socio-economics and tourism.

7.8.4.6 Proposed Additional Survey Requirements

No baseline human health surveys or monitoring is proposed to be undertaken as part of the subsequent stage of the assessment as all publicly available data is considered to be sufficient to undertake any future assessment work if necessary.

7.8.4.7 Data Analysis

Other than the specific assessment to be undertaken and the methodology to be followed, no additional data analysis is anticipated.

7.8.4.8 Consultation

No additional consultation has been undertaken at this time though engagement will be undertaken in Scoping with Aberdeenshire Council, Grampian NHS, and the Aberdeenshire Health and Social Care Partnership.

7.8.4.9 Justification for Removal from Assessment

An examination of all the potential impacts determined whether effects would be long-term, increases above natural variation, and whether the presence of human receptors was permanent or temporary (and thus transient). Given those considerations and findings of recent EIAs for offshore wind farm projects in relation to the potential impacts on human health (being no long-term effects) all health impacts have been scoped out. Table 7.30 provides a description for each effect considered justifying it being scoped out.

Table 7.30 Effects scoped out of the Health Assessment

Health Effect	Justification
Obstruction to PRoW / recreational access	Whilst no formal access is identified within the area, informal access by residents or visitors may occur. However, there is no likelihood of any obstruction occurring beyond the short-term temporary obstruction that could potentially occur on beaches. Given the temporary nature of such disturbance during construction only it is scoped out.
Increased Marine Traffic / Navigation Risk	There would be increased marine traffic immediately offshore of the coast as well as further out (80km) to the offshore wind farm site during construction, and the number would decrease significantly but remain regular throughout the operation phase. The potential receptors at risk are the recreational boating community and all commercial mariners. There are extensive guidelines and rules regarding navigation with more increased requirements and regulations to maintain safe navigation and avoidance of potential 'conflict' such as collisions. Given the existence of significant rules and regulations as well as Notices to Mariners of potential static or related marine traffic activities, no measurable health risks are expected and health impacts to receptors due to increased vessel activity are scoped out.
Visual disturbance	Visual disturbance could arise during construction due to the activities within the marine environment notably cable laying vessels and potentially some vehicular disturbance and related onshore activity within the intertidal zone. (if required as primary approach is HDD and this will remove these activities) These activities are short-term and temporary and mostly screened by the topography and with nearest receptors being predominantly industrial / commercial. Receptors notwithstanding we do not envisage and residual impacts after construction. The offshore wind farm structures are >75km offshore and thus are not visible from the shoreline. Consequently, given the lack of visibility or the temporary nature of such

Health Effect	Justification
	visibility no long-term health effect is expected and thus health impacts due to visual disturbance are scoped out.
Air quality	The offshore works may result in temporary disturbance to sandy beach deposits (if HDD drilling is not possible) which could for a very short-term and temporary duration result in increased dust, whilst the presence of construction vessels could result in localised temporary emissions to air. Both sources of temporary and localised effects would cease on completion of the relevant work and thus no long-term health effect could arise. During operation potential vessel movements would occur offshore the majority being >75km from shore and thus the receptors would be employees or nearby commercial mariners, given the transient nature of those receptors, there temporary nature across localised areas, no long-term health effect could arise. Consequently, air quality impacts are scoped out.
Noise	The offshore works may result in temporary disturbance nearshore which could for a very short-term and temporary duration result in increased noise, whilst the presence of construction vessels could result in localised noise. Given the limited proximity of residential properties and that both these sources of temporary and localised noise would cease on completion of the relevant work, no long-term health effect could arise. During operation potential vessel movements would occur offshore the majority being >75km from shore and thus the noise receptors would be employees or nearby commercial mariners, given the transient nature of those receptors, there temporary nature across localised areas, no long-term health effect could arise. Consequently, noise impacts are scoped out.
Contaminated sediments	Inshore works could result in disturbance to sediments, however, given the very temporary nature of the disturbance and the limited potential for receptors to be present (within the marine environment) and ingest sediment disturbed at specific times for a temporary duration, no long-term health effects are expected. Consequently, contaminated sediment impacts are scoped out.
Water quality	Inshore works could result in disturbance to sediments and related water quality deterioration. However, the very temporary nature of the disturbance and the limited potential for receptors to be present (within the marine environment) and the nature of storm induced disturbances which would result in the same scale of disturbance indicates that, given there is no permanent human presence and at most extremely limited presence if at all, no long-term health effects are expected. Consequently, water quality impacts are scoped out.
Aquaculture	The very limited and temporary disturbance to sediment and water quality in localised areas could affect aquaculture, however as described in relation to water quality, storm induced disturbances would result in the same scale of disturbance indicates that the impacts would fall within the range of natural processes and no additional impacts on aquaculture resources (fish and shellfish) would occur in terms of potential contaminants. Consequently, aquaculture impacts are scoped out.
Climate risks / flood risk	The construction works would occur within the marine environment and would not impact on coastal flood defences or flood risk. As no risk is likely no health effect is expected, and climate risks are scoped out.
Employment opportunities	The construction phase of the development would lead to a short-term and temporary increase in employment expenditure which is likely to be focussed through a specific contractor who is likely to bring in experienced personnel from the wider study area (or even internationally). Whilst there could potentially be some limited and localised temporary construction personnel sourced from the local area this would be limited. In the operational

Health Effect	Justification
	phase, maintenance personnel are more likely to be sourced across a wide geographic area. Given the dispersed nature of the employment opportunities the potential for significant health benefits are thus unlikely. Consequently, employment benefits on health are scoped out.
Electromagnetic fields	Electric and magnetic fields are produced wherever electricity is used, in the home, office, or anywhere else. Electric fields are produced by voltage and magnetic fields by current (it should also be noted that the people are constantly exposed to the earth's magnetic field). The UK policy is to comply with the 1998 International Commission on Non-Ionizing Radiation Protection guidelines in the terms of the 1999 EU Recommendation and the electrical industry has a policy of complying with these guidelines. This limits exposure to magnetic fields of 360μT and electric fields of 9kV/m. In 2004 the National Radiological Protection Board (NRPB now part of PHE) produced Advice on Limiting Exposure to Electromagnetic Fields (NRPB 2004). In this NRPB concluded that "the results of epidemiological studies, taken individually or as collectively reviewed by expert groups, cannot currently be used as a basis for restrictions on exposure to EMFs". Due to the fact that all electrical infrastructure will be built to comply with current standards and that there is little scientific evidence linking EMF exposure to adverse health effects. It is further noted that the marine environment contains no permanent human residences and thus no receptors are present within the marine environment (with the exception of any divers who would only be present near any cables for very short durations). EMF is therefore scope out.

8 Scoping Report Summary

This chapter was produced by Royal HaskoningDHV.

Green Volt is proposing the development of the Green Volt Offshore Windfarm in the North Sea, 75 km east of the Aberdeenshire Coast. Green Volt intends to apply for the required consents, licences and permissions for the construction and operation & maintenance of the offshore infrastructure of the Project. This Offshore Scoping Report examines the offshore infrastructure of the Project, seaward of MHWS. Submission of this Offshore Scoping supports the request for a Scoping Opinion from the Scottish Ministers in relation to Green Volt Offshore Windfarm.

The purpose of this Offshore Scoping Report is to provide stakeholders with information on the proposed Project and allow for stakeholder engagement with the key topics for EIA, as well as the baseline data sources and assessment methodologies that will inform the Offshore EIA Report. The following technical topics have been considered:

Offshore Physical Environment

- Bathymetry
- Geology, geomorphology and offshore sediments
- Metocean conditions
- Water quality
- Sediment quality
- Air quality

Offshore Biological Environment

- Benthic and Intertidal Ecology
- Fish and Shellfish
- Marine Mammals
- Ornithology

Offshore Human Environment

- Seascape, Landscape and Visual Resources
- Shipping and Navigation
- Commercial Fisheries
- Marine Archaeology and Cultural Heritage
- Offshore Social-Economics and Tourism
- Infrastructure and Other Marine Users
- Civil Aviation, Military, Unexploded Ordnance and Communication
- Human Health

A summary of the offshore topics that will be scoped in and scoped out of the EIA have been outlined in the tables below. All impacts that have been scoped in for assessment are considered to represent potential likely significant effects as defined under Environmental Impact Assessment (Scotland) Regulations.

Consultees are invited to consider all of the information provided in this Scoping Report and to provide comments on the proposed approach and, in particular, whether they agree with the conclusions drawn.

Table 8.1 Summary of offshore physical environment topics to be scoped into the EIA (scoped in (✓) and scoped out (x))

Potential impacts	Construction	Operation	Decommissioning	Report Section
5.1 Bathymetry				
Changes to bathymetry (windfarm site)	x	x	x	5.1.3
Changes to bathymetry (export cable) outside 12nm	x	x	x	
Changes to bathymetry (export cable) inside 12nm	✓	✓	x	
Changes to bathymetry (export cable to oil platform)	x	x	x	
5.2 Geology, Geomorphology, and Offshore Sediments				
Increases in suspended sediment	x	x	x	5.2.3
Seabed scour	x	x	x	
5.4 Water Quality				
Pollution of the water through disturbance of the existing contaminated sediments (note that safety zones around old well heads will stop the remobilisation of these sediments in those areas)	✓	x	✓	5.4.3
Pollution of water from unplanned leaks and spills (WTG systems or vessels)	x	x	x	
5.5 Sediment Quality				

Potential impacts	Construction	Operation	Decommissioning	Report Section
Pollution of the sediment through disturbance of the existing contaminated sediments (potentially around old well heads, but areas excluded by safety zones)	✓	x	✓	5.5.3
5.6 Air Quality				
Emissions from vessels	x	x	x	5.6.3
Cumulative effects	✓	✓	✓	5.7
Transboundary effects	x	x	x	5.8

Table 8.2 Summary of offshore biological environment topics to be scoped into the EIA (scoped in (✓) and scoped out (x))

Potential impacts	Construction	Operation	Decommissioning	Report Section
6.1 Benthic and Intertidal Ecology				
Physical disturbance and temporary habitat loss of seabed habitat	✓	x	✓	6.1.3
Physical disturbance and temporary habitat loss of intertidal habitat	✓	x	✓	
Permanent habitat loss	x	✓	x	
Increased suspended sediments and sediment re-deposition	✓	x	✓	
Re-mobilisation of contaminated sediment during intrusive works	✓	x	✓	
Potential impacts on the Southern Trench MPA	✓	x	✓	
Potential impacts on Turbot Bank MPA	x	x	x	
Potential impacts on Buchan Ness to Collieston Coast SAC (and SPA habitats)	x	x	x	
Accidental spills and pollution events	x	x	x	
Cumulative effects	✓	✓	✓	
Transboundary effects	x	x	x	

Potential impacts	Construction	Operation	Decommissioning	Report Section
6.2 Fish and Shellfish				
Physical disturbance and temporary habitat loss of seabed habitat, spawning or nursery grounds or migration routes during intrusive works	✓	✓	✓	6.2.3
Permanent habitat loss	x	✓	x	
Increased suspended sediments and sediment re-deposition	✓	x	✓	
Re-mobilisation of contaminated sediment during intrusive works	✓	x	✓	
Potential impacts on Designated Sites	✓	x	✓	
Underwater noise impacts to hearing sensitive species during pile driving and other activities (vessels, seabed preparation, cable installation etc)	✓	✓	✓	
Introduction of anchors, foundations, scour protection and hard substrate and associated fish aggregation	x	✓	x	
Electromagnetic fields	x	✓	x	
Accidental spills and pollution events	x	x	x	
Cumulative underwater noise	✓	✓	✓	
Cumulative permanent habitat loss	x	✓	✓	

Potential impacts	Construction	Operation	Decommissioning	Report Section
Cumulative changes to seabed habitat	✓	✓	✓	
Cumulative impacts to designated sites	✓	✓	✓	
Transboundary impacts	x	x	x	
6.3 Marine Mammal Ecology				
Underwater noise during UXO clearance	✓	x	x	6.3.3
Underwater noise during foundation installation	✓	x	x	
Underwater noise from other activities (for example rock placement and cable laying)	✓	✓	✓	
Underwater noise and presence of vessels	✓	✓	✓	
Underwater noise from operational wind turbines	x	✓	x	
Barrier effects from underwater noise	✓	✓	✓	
Collision risk with vessels	✓	✓	✓	
Entanglement	x	✓	x	
Disturbance at seal haul-out sites	x	x	x	
Changes in water quality	x	x	x	
Changes to prey availability (including from habitat loss and EMF)	✓	✓	✓	

Potential impacts	Construction	Operation	Decommissioning	Report Section
Barrier effects from physical presence of windfarm	x	✓	x	
Electromagnetic fields direct effects	x	x	x	
Cumulative impacts from underwater noise	✓	✓	✓	
Cumulative impacts from collision risk and entanglement	✓	✓	✓	
Cumulative barrier impacts	x	x	x	
Cumulative disturbance at seal haul-out sites	✓	✓	✓	
Cumulative changes to prey availability (including habitat loss)	✓	✓	✓	
Transboundary impacts	✓	✓	✓	
Inter-relationships	✓	✓	✓	
Interactions	✓	✓	✓	
6.4 Offshore Ornithology				
Direct disturbance and displacement	✓	✓	✓	6.4.3
Displacement / barrier	x	✓	x	
Collision	x	✓	x	
Indirect effects via prey / habitats	✓	✓	✓	

Potential impacts	Construction	Operation	Decommissioning	Report Section
Cumulative	✓	✓	✓	
Transboundary	x	✓	x	

Table 8.3 Summary of offshore human environment topics to be scoped into the EIA (scoped in (✓) and scoped out (x))

Potential impacts	Construction	Operation	Decommissioning	Report Section
7.1 Seascape, Landscape and Visual Resources				
SLVIA offshore (Windfarm Site)	x	x	x	7.1.2 - 7.1.3
SLVIA onshore cable landing (export cable)	x	x	x	
7.2 Shipping and Navigation				
Displacement of vessels	✓	✓	✓	7.2.3
Encounters and vessel to vessel collision	✓	✓	✓	
Allision risk	✓	✓	✓	
Snagging risk (anchored vessels)	✓	✓	✓	
Loss of WTG(s)	✓	✓	✓	
Reduced under keel clearance	✓	✓	✓	
Reduced Search and Rescue (SAR) capabilities	✓	✓	✓	
Navigation, communication, and position fixing equipment	✓	✓	✓	
Electromagnetic interference from export cables	✓	✓	✓	
Cumulative	✓	✓	✓	

Potential impacts	Construction	Operation	Decommissioning	Report Section
Transboundary	✓	✓	✓	
7.3 Commercial Fisheries				
Reduction in access to, or exclusion from established fishing grounds (Windfarm Site).	x	x	x	7.3.3 - 7.3.4.3
Reduction in access to, or exclusion from, established fishing grounds (export cable route)	x	x	x	
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds (Windfarm Site)	x	x	x	
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds (export cable route)	x	x	x	
Displacement or disruption of commercially important fish and shellfish resources (Windfarm Site)	x	x	x	
Displacement or disruption of commercially important fish and shellfish resources (export cable route)	x	x	x	

Potential impacts	Construction	Operation	Decommissioning	Report Section
Construction activities leading to additional steaming to alternative fishing grounds (Windfarm Site)	x	x	x	
Construction activities leading to additional steaming to alternative fishing grounds (export cable route)	x	x	x	
Physical presence offshore windfarm infrastructure leading to gear snagging (Windfarm Site)	x	x	x	
Increased vessel traffic within fishing grounds leading to interference with fishing activity (Windfarm Site)	x	x	x	
Increased vessel traffic within fishing grounds leading to interference with fishing activity (export cable route)	x	x	x	
7.4 Marine Archaeological and Cultural Heritage				
Direct impacts to heritage assets.	✓	✓	✓	7.4.3
Indirect impacts to heritage assets associated with changes to marine physical processes.	x	x	x	
Change to the setting of heritage assets, which could affect their heritage significance.	✓	✓	✓	

Potential impacts	Construction	Operation	Decommissioning	Report Section
Change to character which could affect perceptions of the HSC.	✓	✓	✓	
Cumulative Impacts	x	x	x	
7.5 Offshore Social-Economics and Tourism				
Direct employment (all levels)	✓	✓	✓	7.5.2
Supply chain impacts	✓	✓	✓	
Increase in demand for local private services/goods	✓	✓	✓	
Interference with planned infrastructure improvements in the local area	✓	✓	✓	
Nuisance impacts e.g., noise, lighting	x	x	x	
Impact on recreational activities e.g., coastal path walking	✓	✓	✓	
Increased tourism/business interest to Scotland and local area	x	x	x	
7.6 Infrastructure and Other Marine Users				
Displacement of recreational sailing and motor cruising, recreational fishing (boat angling) and other recreational activities (diving vessels) due to safety zones and advisory safety distances in the array area	✓	✓	✓	7.6.3

Potential impacts	Construction	Operation	Decommissioning	Report Section
and proposed export cable corridor may result in a loss of recreational resource.				
Installation of the export cable, including associated safety distances, may temporarily affect or restrict access to the Hywind Scotland offshore export cable	✓	✓	✓	
Installation of export cable, including safety distances, may temporarily affect or restrict access to the oil pipe.	✓	✓	✓	
Cumulative effects	✓	✓	✓	
7.7 Civil Aviation, Military and Communication				
Interference with long term military exercises or danger areas	x	x	x	7.7.3
Interference with aviation	✓	✓	✓	
Interference with radar	✓	✓	✓	
Potential impact on low flying (including SAR helicopter operations) due to presence of obstacles (cranes, stationary wind turbines).	✓	✓	✓	
UXO	x	x	x	
Cumulative effects	✓	✓	✓	
7.8 Human Health				

Potential impacts	Construction	Operation	Decommissioning	Report Section
Deterioration in air quality / dust / odour	x	x	x	7.8.3
Increased noise / vibration	x	x	x	
Electro-magnetic fields (EMF)	x	x	x	
Ingestion of hazardous substances	x	x	x	
Deterioration in Bathing Water quality	x	x	x	
Increased marine traffic / navigation risk	x	x	x	
Loss of land (agricultural / biodiversity capital)	x	x	x	
Community severance	x	x	x	
Reduced accessibility to infrastructure / public services	x	x	x	
Increased employment	x	x	x	
Loss of / increased local businesses	x	x	x	
Influx of non-resident workforce	x	x	x	
Loss of or increased pressure on existing health, education, recreation, or other community infrastructure or public services	x	x	x	

Potential impacts	Construction	Operation	Decommissioning	Report Section
Visual disturbance and / or alteration to landscape character	x	x	x	
Cumulative effects	x	x	x	

References

Aberdeenshire Health and Social Care Partnership (2017). Health and Social Care Locality Plan North Aberdeenshire 2018 – 2021. Aberdeenshire Council and Grampian NHS.

ABPmer (2017). UK Renewables Atlas. Available at: Atlas of UK Marine Renewables Resources (abpmer.co.uk). [Accessed: November 2021].

Andrews, I. J., Long, D., Richards, P. C., Thomson, A. R., Brown, S., Chesher, J. A., & McCormac, M. (1990). *The geology of the Moray Firth* (Vol. 3). London, UK: HMSO.

ASCOBANS (2015). Recommendations of ASCOBANS on the Requirements of Legislation to Address Monitoring and Mitigation of Small Cetacean Bycatch. October 2015.

Ashley, M.C., Mangi, S.C. & Rodwell, L.D. (2014) The potential of offshore windfarms to act as marine protected areas–a systematic review of current evidence. Marine Policy, 45, 301– 309.

Atkins (2016). Kincardine Offshore Wind Farm ES.

Band, W., 2012. SOSS-02: Using a Collision Risk Model to Assess Bird Collision Risks For Offshore Wind Farms (No. SOSS-02).

Barton, H. and Grant, M. (2006). A health map for the local human habitat. The Journal for the Royal Society for the Promotion of Health, 126 (6). pp. 252-253. ISSN 1466-4240 developed from the model by Dahlgren and Whitehead, 1991.

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.

Bowgen, K., Cook, A., 2018. Bird Collision Avoidance: Empirical evidence and impact assessments (JNCC Report No. 614). JNCC, Peterborough.

British Standards Institute (BSI) (2015). Environmental Impact Assessment for Offshore Renewable Energy Projects – Guide. Available at: https://shop.bsigroup.com/products/environmental-impact-assessment-for-offshore-renewable-energy-projects-guide. [Accessed: November 2021].

Calesurvey and Benthic Solutions Ltd, (2013). Ettrick UKCS Block 20/2a & 20/3a, Habitat Assessment Survey (HAS) Report, Report prepared for Nexen Petroleum U.K. Limited.

Cave, B., Fothergill, J., Pyper, R., Gibson, G., Saunders, P. (2017a). Health in Environmental Impact Assessment: A Primer for a Proportionate Approach. Lincoln, England.

Carlson T, Hastings M, Popper A N (2007). Memorandum – Update on recommendations for revised interim sound exposure criteria for fish during pile driving activities. Sent to California Dept. of Trans. And Washingron Dept. of Trans

Carter, M.I., Boehme, L., Duck, C.D., Grecian, J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C., Moss, S., Thompson, D. and Thompson, P. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS, OESEA-16-76, OESEA-17-78.

Cave, B., FothergilL, J., Gibson, G., Pyper, R., (2017b). Health and Environmental Impact Assessment: A Briefing for Public Health Teams in England. PHE Briefing Note. London, England.

Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2012). Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy

Projects. Available at: https://tethys.pnnl.gov/sites/default/files/publications/CEFAS_2012_Eenvironmental_Assessment_Guidance.pdf. [Accessed: November 2021]

Centre for Marine and Coastal Studies (CMACS) (2003) A baseline assessment of electromagnetic fields generated by offshore wind farm cables.

Centre for Marine and Coastal Studies (CMACS) (2012) East Anglia One Offshore Wind Farm: electromagnetic field environmental appraisal Assessment of EMF effects on sub tidal marine ecology.

Chartered Institute for Archaeologists (2014a). Standards and Guidance for Historic Environment Desk-Based Assessments. [Online] Available at: https://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf

Chartered Institute for Archaeologists (2014b). Code of Conduct. [Online] Available at: https://www.archaeologists.net/sites/default/files/CodesofConduct.pdf

CIEEM (2018) 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.

Connor D. W., Allen J. H., Golding N., Howell K. L., Lieberknecht L. M., Northen K. O., Reker J. B. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough

Cook, A., Johnston, A., Wright, L., Burton, N., 2012. SOSS-02: A review of flight heights and avoidance rates of birds in relation to offshore wind farms (BTO Research Report No. 618). British Trust for Ornithology.

Cook, A.S.C.P., 2021. Additional analysis to inform SNCB recommendations regarding collision risk modelling (No. BTO Research Report 739). Thetford.

Cook, A.S.C.P., Humphreys, E.M., Masden, E.A., Burton, N.H.K., 2014. The Avoidance Rates of Collision Between Birds and Offshore Turbines (No. Volume 5 Number 16), Scottish Marine and Freshwater Science.

Coull, K. A., Johnstone, R., & Rogers, S. I. (1998). Fisheries Sensitivity Maps in British Waters. UKOOA Ltd.

Davies, J., Baxter, J., Bradley, M., Connor, D., Khan, J., Murray, E., Sanderson, W., Turnbull, C., and Vincent, M. (2001). Marine Monitoring Handbook, JNCC, Peterborough, ISBN 1 86107 5243

De Casamajor, M.N., Bru, N and Prouzet, P (1999). Influence de la luminosité nocturne et de la turbidité sur le comportement vertical de migration de la civelle d'anguille (Anguilla anguilla L.) dans l'estuaire de l'Adour. Bull. Fr. Pêche Piscic. 355, 327-347

DECC. (2011). National Policy Statement for renewable Energy Infrastructure (EN-3). Available Online:https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf

Department for Environment, Food and Rural Affairs (Defra) (2003). UK small cetacean bycatch response strategy. Department for Environment, Food and Rural Affairs. March 2003.

Department of Health (2010). Health Impact Assessment of Government Policy: A guide to carrying out a Health Impact Assessment of new policy as part of the Impact Assessment process.

Diederichs, A., Nehls, G., Dähne, M., Adler, S., Koschinski, S. and Verfuß, U. (2008). Methodologies for measuring and assessing potential changes in marine mammal behaviour, abundance or distribution arising from the construction, operation and decommissioning of offshore windfarms. Commissioned by COWRIE Ltd, 231.

Dierschke, V., Furness, R.W., Garthe, S., 2016. Seabirds and offshore wind farms in European waters: Avoidance and attraction. Biological Conservation 202, 59–68. https://doi.org/10.1016/j.biocon.2016.08.016

Drewitt, A.L., Langston, R.H.W., 2006. Assessing the impacts of wind farms on birds. Ibis 148, 29–42. https://doi.org/10.1111/j.1474-919X.2006.00516.x

East Anglia THREE Limited (2015) East Anglia THREE Offshore Wind Farm Environmental Statement

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. Sci. Ser.Tech.Rep., Cefas Lowestoft, 147:56pp

EnCana (2003). Buzzard Development Project Environmental Statement. June 2003. ECB-CM-RPT-00009.

European Environment Agency (EEA). 2019. EUNIS habitat classification. Available from: https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification#tabeuropean-data. Accessed: 10/09/2021.

Farcas, A., Thompson, P. M., & Merchant, N. D. (2016). Underwater noise modelling for environmental impact assessment. Environmental Impact Assessment Review, 57, 114-122.

Flemming, N.C. (2002). The scope of Strategic Environmental Assessment of North Sea areas SEA3 and SEA2 in regard to prehistoric archaeological remains. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/197354/TR_SEA3_Archaeology.pdf

Fraser of Allander Institute (2021) The Economic Impact of Scotland's Renewable Energy Sector, (https://www.scottishrenewables.com/assets/000/001/718/2021_FAI_Economic_Impact_of_Scotland_s_Renewable_Energy_Sector_original.pdf?1622564058).

Fugro (2010). DEBRIS CLEARANCE SURVEYUKCS BLOCK 20/2aPROPOSED LOCATIONS AT BLACKBIRD Survey Period: 15 - 20 February 2010Report No: 00239V1.0 Volume 1: Geophysical Survey Report. Client Report.

Fugro (2013) Rig Site Survey – Blackbird Marine Mammal Observation Report. FSLTD Report No. 130612.6. Fugro EMU Report No. J/1/25/2360.

Fugro, (2011b). Rig Site Survey UKCS Block 20/02, Proposed Location 20/02 Blackbird, FOSPA Repot No. 487/11-J145 on behalf of FSLTD Project No. 00644.5, report produced for Nexen Petroleum Ltd.

Fugro. (2008). Pipeline Route Survey, UKCS Block 20/2a, Ettrick to Blackbird, Volume 1: Geophysical Survey Report, report prepared for RPS Energy on behalf of Nexen Petroleum UK Limited.

Fugro. (2011a). Rig Site Survey UKCS Block 20/02, 20/02 Panda Bear Site Survey, FOSPA Report No. 488/11-J145 on behalf of FSLTD Project No. 00644.6, prepared for Nexen Petroleum UK Limited.

Furness, R., 2015. Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Report 164.

Furness, R.W., Wade, H.M., Masden, E.A., 2013. Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management 119, 56–66. https://doi.org/10.1016/j.jenvman.2013.01.025

Gardline Surveys Limited. (2009). UKCS Block 20/2a, Blackbird Site Survey Report, report produced for Nexen Petroleum UK Ltd.

Gardline (2021) *Ettrick Debris Clearance and Green Volt Environmental Surveys.* Gardline Report Ref 11745-6. E00

Garthe, S., 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. https://doi.org/10.1111/j.0021-8901.2004.00918.x

Genesis. (2016). Ettrick and Blackbird Decommissioning EIA. Report prepared for Nexen Petroleum UK Limited.

Gill, A.B. & Bartlett, M. (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 No.401.

Gill, A.B., Gloyne-Phillips, I., Neal, K.J. and Kimber, J.A. (2005). The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm developments on electrically and magnetically sensitive marine organisms – a review. COWRIE 1.5 Electromagnetic Fields.

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

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.

Halvorsen,M.B., Casper,B,M., Woodley, C.M., Carlson, P,T.,Popper, A,N. (2012)Threshold for onset of injury in Chinook salmon from exposure to impulsive pile driving sounds

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Boerjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M. and Teilmann, J. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research.

Heinänen, S. and Skov, H. (2015). The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No.544 JNCC, Peterborough.

HiDef (2021) Flotation Wind: Peterhead. High-resolution video aerial ornithological and marine megafauna surveyMonthly report –September2020-Survey 01

Higgins, M., Arnot, J., Farman, P., Wares, J., Aboud, S., Douglas, M. J. (2015). Health Impact Assessment of Rural Development: A Guide. Scottish Health and Inequalities Impact Assessment Network and Scottish Public Health Network (ScotPHN).

Historic Environment Scotland (2016). Managing Change in the Historic Environment: Setting. [Online] Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationid=80b7c0a0-584b-4625-b1fd-a60b009c2549.

Historic Environment Scotland (2019). Scotland's Historic Marine Protected Areas. [Online] Available at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=fe248e27-0c19-4e4e-8d65-a62d00a2ce6a.

Hoffman, E., Astrup, J., Larsen, F. & Munch-Petersen, S. (2000) Effects of Marine Wind farms on the Distribution of Fish, Shellfish and Marine Mammals in the Horns Rev Area. Report to

ELSAMPROJEKT A/S. Report No. Baggrundsrapport 24. Danish Institute for Fisheries Research, Lyngby, Denmark

Hydrosearch (2002). Station Report PanCanadian Petroleum Limited Site Survey Geo Prospector, Buzzard Appraisal Wells 20/6-H 20/6-J, March 2002.

IAMMWG (2021). Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680, JNCC Peterborough, ISSN 0963-8091.

ICES International Herring Larvae Survey (IHLS) data North Sea 2005 – 2021. HAWG (ices.dk)

ICES. 2019. Report of the Working Group 2 on cod and plaice egg surveys in the north sea (WGEGGS2). 3-7 December. IJmuiden, The Netherlands. ICES CM 2018/EOSG:09. 37 pp. https://doi.org/10.17895/ices.pub.8159

ICES (2021) Greater North Sea Ecoregion. Available at: Greater North Sea Seabirds (ices.dk)

Institute of Environmental Management and Assessment (IEMA) (2015). IEMA Environmental Impact Assessment Guide to Shaping Quality Development.

IEMA, IHBC & Chartered Institute for Archaeologists (2021). Principles of Cultural Heritage Impact Assessment in the UK. [Online] Available at: https://www.archaeologists.net/sites/default/files/j30361_iema_principlesofchia_v8.pdf.

Inger, R., Attrill, M.J. Bearhop, S., Broderick, A.C., Grecian, J., Hodgeson, D.J., Mills, C., Sheehan, E., Votier, S.C.m Witt, M.J. and Godlet, B.J. (2009). Marine renewable energy: potential benefits to biodiversity? An urgent call for research. Journal of Applied Ecology. 46 96): pp. 1145-1153.

Isaacman, L. and Daborn, G. (2011). Pathways of Effects for Offshore Renewable Energy in Canada. Report to Fisheries and Oceans Canada. Acadia Centre for Estuarine Research (ACER) Publication No. 102, Acadia University, Wolfville, NS, Canada. 70 pp

Jensen, B. A., Klaustrup, M. and Skov, H. (2006) EIA Report. Fish. Horns Rev 2 Offshore wind farm. Bioconsult.

JNAPC (2006). Code for Practice for Seabed Development. [Online] Available at: http://www.jnapc.org.uk/jnapc_brochure_may_2006.pdf.

JNCC and Defra (on behalf of the Four Countries' Biodiversity Group). (2012). UK Post-2010 Biodiversity Framework. July 2012. Available from: http://jncc.defra.gov.uk/page-6189. Accessed: 10/09/2021.

JNCC, Natural England and CCW (2010). Draft EPS Guidance - The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Joint Nature Conservation Committee, Natural England and Countryside Council for Wales. October 2010.

JNCC. 2018. Conservation Objectives for Turbot Bank Nature Conservation Marine Protected Area. Available from: https://hub.jncc.gov.uk/assets/63f05a50-a78b-4a58-9bde-d78261780729#TurbotBank-2-ConservationObjectives-V1.0.pdf. Accessed: 10/09/2021.

Johnston, Alison, Cook, A.S.C.P., Wright, L.J., Humphreys, E.M., Burton, N.H.K., 2014. Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology 51, 31–41. https://doi.org/10.1111/1365-2664.12191

Johnston, A, Cook, A.S.C.P., Wright, L.J., Humphreys, E.M., Burton, N.H.K., 2014. Corrigendum. Journal of Applied Ecology 51, 31–41. https://doi.org/doi: 10.1111/1365-2664.12191

Joint Nature Conservation Committee (JNCC) (2009). Selection Criteria and Guiding Principles For Selection Of Special Areas Of Conservation (SACs) For Marine Annex I Habitats And Annex II Species In The UK. JNCC, Peterborough.

Kafas, A., McLay, A., Chimienti, M., and Gubbins M., (2014). ScotMap Inshore Fisheries Mapping in Scotland: Recording Fishermen's use of the Sea. Scottish Marine and Freshwater Science Volume 5 Number 17.

KOWL (Kincardine Offshore Wind Ltd), 2019. Kincardine Offshore Windfarm Project: Project Environmental Monitoring Plan. (No. KOWL-PL-0004-005).

Kröncke I. (2011). Changes in Dogger Bank macrofauna communities in the 20th century caused by fishing and climate. Estuarine, Coastal and Shelf Science 94: 234-245.

Künitzer A, Basford D, Craeymeersch JA, Dewarumez JM, Dörjes J, Duineveld GCA, Eleftheriou A, Heip C, Herman P, Kingston P, Niermann U, Rachor E, Rumohr H & de Wilde PAJ. (1992). The benthic infauna of the North Sea: species distribution and assemblages. ICES Journal of Marine Science 49: 127-143.

Leonhard, S.B. and J. Pedersen, 2005. Hard bottom substrate monitoring. Horns Rev offshore Wind Farm. Annual status report 2004. Bio/consult. Report commissioned by Elsam Engineering: 1-79

Lindeboom, H. J., Kouwenhoven, H. J, Bergman, M. J. N., Bouma, S., Brasseur, S., Daan, R., Fijn, R. C., de Haan, D., Dirksen, S., van Hal R, Hille Ris Lambers, R, ter Hofstede, R., Krijgsveld K L, Leopold, M., and Scheidat, M. (2011). Short-term ecological effects of an offshore windfarm in the Dutch coastal zone; a compilation. Focus on the Environmental Impact of Wind Energy Environmental Research Letters Volume 6 Number 36 035101 doi:10.1088/1748-9326/6/3/035101

London HUDU (2019). Rapid Health Impact Assessment Tool.

London Healthy Urban Development Unit (HUDU) (2017). Healthy Urban Planning Checklist. Third Edition, April 2017.

MacArthur Green, 2019. Auk Tagging and Monitoring. Interim Report 2019 (European Offshore Wind Deployment Centre Environmental Research & Monitoring Programme). Vattenfall.

MacArthur Green, 2018. Auk Tagging and Monitoring Interim Report 2018 (European Offshore Wind Deployment Centre Environmental Research & Monitoring Programme). Vattenfall.

Maclean I.M.D., Wright L.J., Showler D.A. and Rehfisch M.M. (2009). A Review of Assessment Methodologies for Offshore Wind farms (COWRIE METH-08-08). Available at: https://tethys.pnnl.gov/sites/default/files/publications/Maclean-et-al-2009.pdf. [Accessed: November 2020]

Marine Scotland (2011). Blue Seas – Green Energy: A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters. Available at: https://www2.gov.scot/Resource/Doc/346375/0115264.pdf. Accessed October 2021.

Marine Scotland (2012). MS Offshore Renewables Research: Work Package A3: Request for advice about the displacement of marine mammals around operational offshore windfarms. Available at: http://www.gov.scot/Resource/0040/00404921.pdf.

Marine Scotland (2013). Planning Scotland's Seas: SEA of Plans for Wind, Wave and Tidal Power in Scottish Marine Waters Environmental Report. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/impact-assessment/2013/07/draft-sectoral-marine-plans-offshore-renewable-energy-scottish-waters-strategic/documents/00428212-pdf/00428212-pdf/govscot%3Adocument/00428212.pdf Accessed October 2021.

Marine Scotland (2015a). Scotland's National Marine Plan: A Single Framework for Managing Our Seas. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2015/03/scotlands-national-marine-plan/documents/00475466-pdf/00475466-pdf/govscot%3Adocument/00475466.pdf. Accessed June 2020.

Marine Scotland (2018a). Scoping 'Areas of Search' Study for offshore wind energy in Scottish Waters Available at: https://www.gov.scot/publications/scoping-areas-search-study-offshore-wind-energy-scottish-waters-2018/documents/ [Accessed: November 2021]

Marine Scotland (2018b). Marine Scotland Consenting and Licensing Guidance For Offshore Wind, Wave and Tidal Energy Applications. Available at: https://www.gov.scot/publications/marine-scotland-consenting-licensing-manual-offshore-wind-wave-tidal-energy-applications/documents/ [Accessed: November 2021].

Marine Scotland Science (2015b) landings data

Marine Scotland (2021) NorthConnect HVDC Cable - Marine License and consent (accessed 28/10/2021). Available at: https://marine.gov.scot/ml/northconnect-hvdc-cable

Masden, E.A., Haydon, D.T., Fox, A.D., Furness, R.W., 2010. Barriers to movement: Modelling energetic costs of avoiding marine wind farms amongst breeding seabirds. Marine Pollution Bulletin 60, 1085–1091. https://doi.org/10.1016/j.marpolbul.2010.01.016

Masden, E.A., Reeve, R., Desholm, M., Fox, A.D., Furness, R.W., 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. https://doi.org/10.1098/rsif.2012.0121

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J., McCabe, K. (2000). Marine seismic surveys - a study of environmental implications APPEA J.,40, pp. 692-706

McConnell, B., Lonergan, M. and Dietz, R. (2012). Interactions between seals and offshore wind farms. The Crown Estate. ISBN: 978-1-906410-34-5.

McGregor, R.M., King, S., Donovan, C.R., Caneco, B., Webb, A., 2018. A Stochastic Collision Risk Model for Seabirds in Flight. Marine Scotland.

Metcalfe, O., Higgins, C., Lavin, T. (2009). Health Impact Assessment Guidance.

Miller J.H., Potty G.R. and Kim H.K. (2016) Pile-Driving Pressure and Particle Velocity at the Seabed: Quantifying Effects on Crustaceans and Groundfish. In Popper A.N., and Hawkins A.D. The effects of noise on aquatic life, II. (pp. 719 - 729). Springer Science+Business Media, New York

Ministry of Housing, Communities and Local Government (MHCLG) (2019a). National Planning Policy Framework.

MHCLG (2019b). Guidance: Healthy and safe communities.

MHCLG (2019c) English indices of deprivation 2019.

MHCLG (2020). Guidance: Environmental Impact Assessment.

MMO (2014) Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation. MMO Project No: 1031. ISBN: 978-1-909452-24-4. 164pp

Mueller-Blenkle, C., McGregor, P.K., Gill, A.B., Andersson, M.H., Metcalfe, J., Bendall, V., Sigray, P., Wood, D.T. & Thomsen, F. (2010) Effects of Pile-driving Noise on the Behaviour of Marine Fish. COWRIE Ref: Fish 06-08, Technical Report 31st March 2010

Mueller-Blenkle, W.H., Skalski, J.R., Malme C.I. (1992). Effects of sounds from a geophysical survey device on behaviour of captive rockfish (Sebastes spp.) Can. J. Fish. Aquat. Sci.,49, pp. 1343-1356

NAMMCO. (2020). Estimates of Cetacean Abundance in the North Atlantic of Relevance to NAMMCO. NAMMCO Scientific Publications, 11. https://doi.org/10.7557/3.5732.

National Biodiversity Network (NBN) Atlas Available at NBN Atlas - UK's largest collection of biodiversity information

National Health Service (2017) Healthy Urban Planning Checklist.

National Health Service Scotland (2017), Place Standard Tool. Accessed at: https://www.placestandard.scot/

National Radiological Protection Board (NRPB) (2004) Advice on Limiting Exposure to Electromagnetic Fields (0-300 GHz). ISBN: 0-85951-532-X Available at: [ARCHIVED CONTENT] HPA - Documents of the NRPB: Volume 15, No. 2 (nationalarchives.gov.uk)

Natural Research Projects Ltd, 2015. Hywind Scotland Pilot Park. Seabirds and Marine Mammals Technical Report (Report to Statoil ASA No. A-100142-S23_TECH-001). Banchory.

NatureScot (2012a) Observed adjusted densities of Basking shark (Cetorhinus maximus) (all seasons 2000-2012) (Priority Marine Feature) (SNH WMS) |

NatureScot. (2012b). Sand Dune Vegetation Survey of Scotland. Available from: https://map.environment.gov.scot/sewebmap/?layers=HabVegSurvey1&extent=-298028,475191,719972,1268192. Accessed: 10/09/2021.

NatureScot. (2020). Southern Trench MPA, Conservation and Management Advice. Available from: https://sitelink.nature.scot/site/10477. Accessed: 10/09/2021.

Nedwell, J. R., Parvin, S. J., Edwards, B., Workman. R., Brooker, A. G. and Kynoch, J. E. (2007). Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters. Subacoustech Report No. 544R0738 to COWRIE Ltd. ISBN: 978-0- 9554279-5-4

Nexen (2005) Ettrick Field Development Environmental Statement. October 2005. DTI Project Reference No. W/2817/2005.

Nexen (2016) Ettrick and Blackbird Decommissioning EIA. Nov, 2016. Document/Rev No: J73319B-Y-RT-24006/D3.

Nexen Petroleum UK Limited. (2010). Blackbird Development Environmental Statement, Doc. No. BBD-HS-STA-00011, RevB

Nicholson, D., Harris, E. & Pollard, S. (2000). The location and usage of sites in Scotland by the basking shark Cetorhinus maximus. Scottish Natural Heritage Commissioned Report F99AA402

NOAA (National Oceanic and Atmospheric Administration), 2018. National Report on Large Whale Entanglement Confirmed in the United States in 2017. NOAA Fisheries.

Normandeau, Exponent, T. Tricas, and A. Gill. (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.

NorthConnect. (2018). High Voltage Direct Current Cable Infrastructure, UK Environmental Impact Assessment Report, Volume 2. Available from: https://marine.gov.scot/ml/marine-licence-cable-installation-between-peterhead-scotland-and-simadalen-norway-06771-06870. Accessed 10/09/2021

ORCA (2021). The State of European Cetaceans 2021. Available from: https://www.orcaweb.org.uk/our-work/the-state-of-european-cetaceans

OGUK (2021). North Sea Transition Deal. Available from: https://www.gov.uk/government/publications/north-sea-transition-deal

OSPAR, 2008. OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR Reference Number: 2008-6). [Online] Available at: https://www.ospar.org/site/assets/files/1505/08-06e_ospar_list_species_and_habitats.doc [Accessed 27 July 2021]

OSPAR, 2010. OSPAR Background Document for Seapen and Burrowing megafauna Communities (OSPAR ref. no. 481/2010). [Online] Microsoft Word - P00481_Seapen and burrowing megafauna.doc (ospar.org)

Oxford Archaeology (2008). Guidance for the Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy. Guidance prepared by Oxford Archaeology and issued by COWRIE. [Online] Available at: http://www.biofund.org.mz/wp-content/uploads/2018/11/F1349.Cowrie-Ciarch-Web.pdf.

Palframan, L (n.d.) The Integration Of Environmental Impact Assessment And Environmental Management Systems: Experiences From The UK. School of Life Sciences, University of Hertfordshire. Available at: 904108.pdf (herts.ac.uk)

Paxton, C.G.M., Scott-Hayward, L., Mackenzie, M., Rexstad, E. and Thomas, L. (2016). Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources with Advisory Note, JNCC Report 517, ISSN 0963-8091: http://jncc.defra.gov.uk/page-7201.

Place Standard (2021) Place Standard Tool – Stategic Plan 2020 – 2023. Available at: Place_Standard_Strategic_Plan.pdf (placestandard.scot)

Popper A N, Carlson T J, Hawkins A D, Southall B D, Gentry R L (2006). Interim criteria for injury in fish exposed to a pile driving operation. A white paper, available from http://www.wsdot.wa.gov/NR/rdonlyres/84A6313A-9297-42C9-BFA6-750A691E1DB3/0/BA_PileDrivingInterimCriteria.pdf

Popper AN, Hawkins AD, Fay RR, Mann D, Bartol S, Carlson T, Coombs S, Ellison WT, Gentry R, Halvorsen MB, Løkkeborg S, Rogers P, Southall BL, Zeddies D and Tavolga WN (2014). Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report, ASA S3/SC1.4 TR-2014 prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Springer and ASA Press, Cham, Switzerland.

Public Health England (2020a). Health Impact Assessment in spatial planning, A guide for local authority public health and planning teams.

PHE (2021a). Public Health Outcomes Framework.

PHE (2021b). Wider Determinants of Health.

PHE (2021c) Local Authority Health Profiles.

Reid, J. B., Evans, P. G. and Northridge, S. P. (2003). Atlas of Cetacean distribution in north-west European waters. JNCC.

Roberts L. and Breithaupt T. (2016) Sensitivity of Crustaceans to Substrate- Borne Vibration. In Popper A.N., and Hawkins A.D. The effects of noise on aquatic life, II. (pp. 925 - 932). Springer Science+Business Media, New York.

Rogers, S. & Stocks, S. (2001). North Sea Fish and Fisheries. Technical report for Strategic Environmental Assessment (SEA) pp. 72.

RPS. (2013). Independent Geohazard Assessment, Ettrick DCM Revised Well Location, UKCS, Block 20/2a & 20/3a. Report prepared for Nexen Petroleum UK Limited.

Russell, D.J.F, Jones, E.L. and Morris, C.D. (2017). Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science Vol 8 No 25, 25pp. DOI: 10.7489/2027-1.

Russell, D.J.F. and McConnell, B.J. (2014). Seal at-sea distribution, movements and behaviour. Report to DECC. URN: 14D/085. March 2014 (final revision).

Rystad Energy, 2020 https://www.rystadenergy.com/newsevents/news/press-releases/top-north-sea-emitter-uk-needs-to-electrify-its-rising-oil-and-gas-output-to-reach-climate-goals/

Scheidat, M., Tougaard, J., Brasseur, S., Carstensen, J., van Polanen Petel, T., Teilmann, J. and Reijnders, P. (2011). Harbour porpoise (Phocoena phocoena) and wind farms: a case study in the Dutch North Sea. Environ. Res. Lett. 6 (April-June 2011) 025102.

SCOS (2017). SCOS Report. Scientific Advice on Matters Related to the Management of Seal Populations: 2017. http://www.smru.st-andrews.ac.uk/files/2018/01/SCOS-2017.pdf

SCOS (2020). Scientific Advice on Matters Related to the Management of Seal Populations: 2020. Available at: http://www.smru.st-andrews.ac.uk/research-policy/scos/

Scotland's marine economic statistics (2018), released 14th October 2020 (https://www.gov.scot/publications/scotlands-marine-economic-statistics-2018/pages/3/).

Scottish Archaeological Research Framework (SCARF) (2012). From Source to Sea: ScARF Marine and Maritime Panel Report. Online [Available at]: https://scarf.scot/wp-content/uploads/sites/15/2015/12/ScARF%20Source%20to%20Sea%20September%202012.pdf.

Scottish Government (2014). Scotland's Third National Planning Framework . Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice. Accessed October 2021

Scottish Government (2014b). Scottish Planning Policy. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2014/06/scottish-planning-policy/documents/00453827-pdf/00453827-pdf/govscot%3Adocument/00453827.pdf Accessed October 2021.

Scottish Government (2017). Planning Circular 1/2017: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017;

Scottish Government (2017). The Scottish Energy Strategy: The Future of Energy in Scotland. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2017/12/scottish-energy-strategy-future-energy-scotland-9781788515276/documents/00529523-pdf/00529523-pdf/govscot%3Adocument/00529523.pdf. Accessed September 2021.

Scottish Government (2019). Offshore renewable energy: decommissioning guidance. Available at https://www.gov.scot/publications/decommissioning-offshore-renewable-energy-installations-scottish-waters-scottish-part-renewable-energy-zone-under-energy-act-2004-guidance-notes-industry-scotland/documents/ [Accessed November 2021]

Scottish Government (2020a). Sectoral Marine Plan for Offshore Wind Energy. Available at: https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/documents/ Accessed November 2021.

Scottish Government (2020b). Offshore Wind Policy Statement. Available at: https://www.gov.scot/publications/offshore-wind-policy-statement/documents/ [Accessed November 2021]

Scottish Government, (2020c). Scottish Sea Fisheries Statistics 2019 available online at https://www.gov.scot/publications/scottish-sea-fisheries-statistics-2019/documents/ [Accessed 31/08/2021

Sea Watch Foundation (2021). Reports of cetacean sightings eastern England: Available at: http://www.seawatchfoundation.org.uk/recentsightings/

Searle, K., Mobbs, D., Daunt, F., Butler, A., 2019. A Population Viability Analysis Modelling Tool for Seabird Species (Natural England Commissioned Report No. ITT_4555).

Sharples R.J., Matthiopoulos, J. and Hammond, P.S. (2008). Distribution and movements of harbour seals around the coast of Britain: Outer Hebrides, Shetland, Orkney, the Moray Firth, St Andrews Bay, The Wash and the Thames, Report to DTI July 2008.

Skinner, A., Young, M. & Hastie, L (2003), Ecology of the Freshwater Pearl Mussel, Conserving Natura 2000 Rivers Ecology Series No. 2, English Nature, Peterborough, http://www.snh.gov.uk/docs/B337911.pd

Skov, H., Heinänen, S., Norman, T., Ward, R.M., Méndez-Roldán, R.S., Ellis, I., 2018. ORJIP Bird Collision and Avoidance Study. Final report – April 2018. The Carbon Trust.

SNH (2017) SNH Commissioned Report 406: Descriptions of Scottish Priority Marine Features (PMFs)

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L. (2019). Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2), pp.125-232.

Sparling, C.E., Coram, A.J., McConnell, B., Thompson, D., Hawkins, K.R. and Northridge S.P. (2013). Paper Three: Mammals. Wave & Tidal Consenting Position Paper Series.

Speakman, J., Gray, H., Furness, L., 2009. University of Aberdeen report on effects of offshore wind farms on the energy demands of seabirds. (Report to the Department of Energy and Climate Change).

Stenberg, Claus & Støttrup, J.G. & Deurs, Mikael & Berg, C.W. & Dinesen, Grete & Mosegaard, Henrik & Grome, T. & Leonhard, S.. (2015). Long-term effects of an offshore wind farm in the North Sea on fish communities. Marine Ecology Progress Series. 528. 257–265,. 10.3354/meps11261.

Stienen, E., Waeyenberge, V., Kuijken, E., 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., Ferrer, M. (Eds.), Birds and Wind Farms. Quercus, Madrid.

Taylor, L (2010) *Luftwaffe over Scotland: A History of German Air Attacks on Scotland 1939-45.* Whittles Publishing: Dunbeath.

Teilmann, J., Carstensen, J., Dietz, R., Edrén, S. and Andersen, S. (2006). Final report on aerial monitoring of seals near Nysted Offshore Wind Farm Technical report to Energi E2 A/S. Ministry of the Environment Denmark.

The Crown Estate (2015). Global Offshore 2015: offshore wind overview and UK wind resource dataset. Available at: 2015 - Global Offshore 2015: offshore wind overview and UK wind resource dataset with improved accuracy published | The Crown Estate

The Planning Inspectorate (2019). *Advice Note Seventeen: Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects*. Available at: Advice-note-17V4.pdf (planninginspectorate.gov.uk). Accessed October 2021.

Thomsen F., Gill A., Kosecka M., Andersson M.H., Andre M., Degraer S. and Norro A. (2015) MaRVEN–Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewable Energy. Final study report. Brussels, Belgium.

Tougaard, J., Carstensen, J. and Teilmann, J. (2009a). Pile driving zone of responsiveness extends beyond 20km for harbour porpoises (Phocoena phocoena (L.)) (L). J. Acoust. Soc. Am., 126, pp. 11-14.

Tougaard, J., Carstensen, J., Wisch, M.S., Teilmann, J., Bech, N., Skov, H. and Henriksen, O.D. (2005). Harbour porpoises on Horns reef—effects of the Horns Reef Wind farm. Annual Status Report 2004 to Elsam. NERI, Roskilde (Also available at: www.hornsrev.dk).

Tougaard, J., Henriksen, O.D. and Miller. L.A. (2009b). Underwater noise from three types of offshore wind turbines: estimation of impact zones for harbour porpoise and harbour seals. Journal of the Acoustic Society of America 125(6): 3766.

UK SNCBs, 2014. Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review.

UK SNCBs, 2017. Joint SNCB Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments.

UKDMAP (1998). An Atlas of the seas around the British Isles. Third Edition, British Oceanographic Data Centre: Birkenhead.

Wade, H.M., Masden, E.A., Jackson, A.C., Furness, R.W., 2016. Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments. Marine Policy 70, 108–113. https://doi.org/10.1016/j.marpol.2016.04.045

Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T. (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), pp.253-269. https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2664.13525.

Wales Health Impact Assessment Support Unit (WHIASU) (2012). Health Impact Assessment: A Practical Guide.

Wessex Archaeology (2007). Historic Environment Guidance for the Offshore Renewable Energy Sector. Guidance prepared by Wessex Archaeology and issued by COWRIE. [Online] Available at: https://www.wessexarch.co.uk/sites/default/files/field_file/COWRIE_2007_Wessex_%20-%20archaeo_%20guidance_Final_1-2-07.pdf.

World Ocean Review (2017) *WOR 5 Coasts – A Vital Habitat Under Pressure.* [Online] Available at: https://worldoceanreview.com/en/wor-5/coastal-dynamics/on-the-origin-and-demise-of-coasts/

Wilson, B. Batty, R. S., Daunt, F. and Carter, C. (2007). Collision risks between marine renewable energy devices and mammals, fish and diving birds. Report to the Scottish Executive. Scottish Association for Marine Science, Oban, Scotland, PA37 1QA.

Wright, L.J., Ross-Smith, V.H., Austin, G.E., Massimino, D., Dadam, D., Cook, A.S.C.P., Calbrade, N.A., Burton, N.H.K., 2012. SOSS-05: Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species) (BTO Research Report No. 590), SOSS05. British Trust for Ornithology.

Wyn, G., Brazier, P., Birch, K., Bunker, A., Cooke, A., Jones, M., Lough, N., McMath, A., and Roberts, S. (2006). Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey, CCW, Bangor, ISBN 1 86169 144

Annex A – Proposed Consultation List

Stakeholder	Key areas of Consultation	Stakeholder	Key areas of Consultation
Scottish Government (Energy Division)	All elements of the EIA	National Grid and DNO	Design, technology, cables, grid
Crown Estate Scotland	All elements of the EIA	Network Rail	Onshore cable routes
Marine Scotland	All elements of the EIA	Scottish Water	Onshore cable routes
Aberdeen City Council	All elements of the EIA	Oil and Pipelines Agency	Cable routes
Aberdeenshire Council	All elements of the EIA	Receiver of Wreck	Cable routes, archaeology
Angus Council	All elements of the EIA	Historic Scotland	Cultural heritage, archaeology
Scottish Environment Protection Agency	All elements of the EIA	National Trust for Scotland	Cultural heritage, archaeology
Aberdeen Renewable Energy Group	All elements of the EIA	Local Golf Clubs	Landscape and seascape
Marine Safety Forum	All elements of the EIA	Joint Nature Conservation Committee	Ecology and nature conservation
Nature Scot	Ecology, landscape and seascape	Scottish Wildlife Trust	Ecology and nature conservation
Aberdeen Chamber of Commerce	Socio-economics	Scottish Environment LINK	Ecology and nature conservation
Planning (Scotland)	Socio-economics	RSPB Scotland	Ecology and nature conservation
Scottish Enterprise	Socio-economics	Whale and Dolphin Conservation Society Scotland	Marine mammals
Transport Scotland	Socio-economics	University of Aberdeen – Lighthouse Field Station	Marine mammals
Visit Scotland	Socio-economics	University of St Andrews - Sea Mammal Research Unit	Marine mammals
Historic Environment Scotland (HES)	Cultural Heritage	Association of District Salmon Fisheries Board	Fisheries and aquaculture
East Grampian Coastal Partnership	Cultural Heritage	Atlantic Salmon Trust	Fisheries and aquaculture
Chamber of Shipping	Navigation and shipping	Scottish Fisherman's Federation	Fisheries and aquaculture
Aberdeen Harbour Board	Navigation and shipping	Scottish Fisherman's Organisation	Fisheries and aquaculture

Marine and Coastguard Agency	Navigation and shipping	Local Fisherman's Organisations	Fisheries and aquaculture
Northern Lighthouse Board	Navigation and shipping	Scottish Federation of Sea Anglers	Fisheries and aquaculture
Royal National Lifeboat Institution	Navigation and shipping	Inshore Fishery Groups	Fisheries and aquaculture
Local Ports and Harbours	Navigation and shipping	Royal Yachting Association (Scotland)	Recreational maritime use
Civil Aviation Authority	Aviation, electromagnetics	Local Sailing Clubs	Recreational maritime use
Aberdeen International Airport	Aviation, electromagnetics	Scottish Canoe Association	Recreational maritime use
National Air Traffic Services	Aviation, electromagnetics	Scottish Sub-aqua Club	Recreational maritime use
Defence Infrastructure Organisation	Military radar, naval and aviation	Scottish Surfing Federation	Recreational maritime use
British Telecom (Radio Network Protection Team)	Electromagnetics	Sport Scotland	Recreational maritime use
Joint Radio Company	Electromagnetics	Surfers Against Sewage	Recreational maritime use
OFCOM	Electromagnetics		
Department of Energy and Climate Change (Aberdeen)	Design and technology		

Royal HaskoningDHV is an independent, international engineering and project management consultancy with over 138 years of experience. Our professionals deliver services in the fields of aviation, buildings, energy, industry, infrastructure, maritime, mining, transport, urban and rural development and water.

Backed by expertise and experience of 6,000 colleagues across the world, we work for public and private clients in over 140 countries. We understand the local context and deliver appropriate local solutions.
We focus on delivering added value for our clients while at the same time addressing the challenges that societies are facing. These include the growing world population and the consequences for towns and cities; the demand for clean drinking water, water security and water safety; pressures on traffic and transport; resource availability and demand for energy and waste issues facing industry.

We aim to minimise our impact on the environment by leading by example in our projects, our own business operations and by the role we see in “giving back” to society. By showing leadership in sustainable development and innovation, together with our clients, we are working to become part of the solution to a more sustainable society now and into the future.

Our head office is in the Netherlands, other principal offices are in the United Kingdom, South Africa and Indonesia. We also have established offices in Thailand, India and the Americas; and we have a long standing presence in Africa and the Middle East.

ETHIC Intelligence
CERTIFICATE ANTI-CORRUPTION COMPLIANCE SYSTEM

royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together